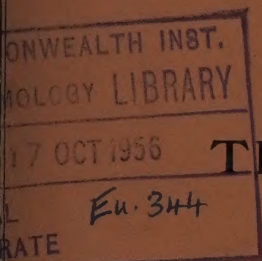


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THE PHALLIC COMPLEX IN ACRIDOIDEA (ORTHOPTERA) IN RELATION TO TAXONOMY.

By V. M. DIRSH, D.Sc., F.R.E.S.

(*Anti-Locust Research Centre, London.*)

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With 66 line Plates.

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INTRODUCTION.

IN this work the phallic complex in the Acridoidea is studied in relation to the classification of this suborder.

Since the genitalia serve only one function and are located internally, they are probably less affected than most other morphological features by environmental conditions and less subject to adaptive changes during the phylogenetic history. A comparative study of them may therefore help to trace the interrelations of the groups more clearly than the external characters, on which the current classification is based.

All the known families of the suborder are included in this work, except the Tetrigidae which are regarded by the author as a distinct suborder, Tetrigoidea.

As a result of this study the erection of some new families and subfamilies and rearrangement of some of the old ones became necessary.

ACKNOWLEDGMENTS.

I wish to express my sincere gratitude to Dr. B. P. Uvarov, F.R.S., for his most valuable advice in taxonomic problems and constant help in solving many difficult questions arising during my work; to Dr. T. H. C. Taylor for correcting the manuscript; and to Miss J. B. Mason for preparing the index.

MATERIAL AND METHODS.

Representatives of 778 genera and about twice as many species were studied, these comprising most of the genera in the British Museum (Natural History) together with a few from other European museums.

Since the specimens used were mostly dried, they were first put in a relaxing box for 24 hours or more. When the tissues were sufficiently soft, the supra-anal plate was raised with a needle, the pallium cut laterally and the phallic complex uncovered; the whole complex was then gently pulled out and the rest of the pallium cut. The external covering (supra-anal plate, paraprocts, subgenital plate) remained undamaged and could be returned to its normal position, so that the external view of the insect appeared unchanged by the operation. The complex was then immersed in 10 per cent. caustic-potash solution for 2-16 hours; this was found preferable to boiling in caustic-potash, which was too drastic. Further treatment consisted of removing the muscular tissues and tracheae, and washing in water. The whole complex was then figured with a camera lucida. The ectophallic membrane and epiphallus were then removed and the remainder of the complex drawn again. In addition, the whole cingulum, or only its apodemes and zygoma, were removed and the remaining parts (the endophallus, sometimes with parts of the cingulum)

drawn. The next stage was to remove the sacs and to draw the sclerotised parts of the endophallus. All these drawings were made from dorsal, ventral and lateral aspects. When all parts of the phallic organ were separately drawn, the structure of the endophallic sac could be easily reconstructed.

All the figures in this work are semi-diagrammatic, details such as superficial sculpturing being omitted. It must be emphasised that it was not always possible to orientate all parts of the phallic complex in exactly corresponding positions, but care was taken to draw them in approximately the same positions in all cases. It was especially difficult to draw the epiphalli, since their surface is sometimes curved in a most peculiar manner (Pl. 1, figs. 3-5) and the smallest change of the angle of view results in a very different outline. All the epiphalli were drawn from the dorsal aspect, and in a position to show their structure most clearly. When the figures are compared with the actual preparations or with figures in other works, it must be realised that they may be viewed from different angles.

All drawings are orientated with the anterior end towards the top of the page. In the profile drawings the posterior end is on the right.

TERMINOLOGY OF THE PARTS OF THE PHALLIC COMPLEX (EXCEPT THE EPIPHALLUS) AND EXPLANATION OF SYMBOLS USED IN THE PLATES.

The modern terminology of parts of the phallic complex was established in the works of Chopard (1920), Walker (1922) and Snodgrass (1935-37), and revised by Radclyffe-Roberts (1941). In the present work the last author's terminology is largely retained, but a few changes have been made for a clearer understanding of the position and significance of certain parts.

The structures (except the epiphallus, see p. 229) are listed below in alphabetical order of symbols used for them in the plates. Main synonyms of previous authors are given in brackets.

Aa, *appendices of aedeagus* (Pl. 13). Sclerites, mostly of ectophallic but sometimes of endophallic origin.

Ac, *arch of cingulum* (Pls. 15, 29, 32, 47, 48, 51, 55). A small sclerite which forms a connection between the zygoma and the valves of the penis or the dorsal wall of the spermatophore sac. It often bears a pair of valves of the cingulum. (*Bridge of anterior phallotreme sclerites*, Snodgrass, 1935; *arch of dorsal valves*, Radclyffe-Roberts, 1941)

Ach, *aedeagal chamber* (Pl. 13). A chamber of unknown function formed by the appendices of the aedeagus; probably of ectophallic origin. Found only in the genus *Systella*.

Aed, *aedeagus*. The distal complex of the phallus serving as the intromittent organ. Morphologically it represents a complex of elements of the ectophallus and endophallus, though sometimes consisting of either the one or the other. The name is used here only in its functional and not in its morphological sense. (*Aedeagus* Snodgrass, 1935, 1937; Radclyffe-Roberts, 1941; *penis*, Walker, 1922; Chopard, 1920).

Ap, *apical valves of penis* (Pl. 2). Distal valves of the penis, in those cases in which the penis is divided into two parts, or the distal half of the undivided penis. Their function is to participate in the transmission of the spermatophore to the female genital chamber. (*Posterior ventral apical process of aedeagus*, Snodgrass,

1935; partly ventral valves of aedeagus and partly aedeagal valves, Radclyffe-Roberts, 1941; also ectoparameres, Walker, 1922.)

Apd, apodemes (Pl. 2, figs. 4-8). A pair of usually strongly sclerotised structures, situated dorsally to the endophallus (in the Trigonopterygidae ventrally to it); they are a part of the cingulum. (*Apodemes*, Snodgrass, 1935; Radclyffe-Roberts, 1941; *endapophyses*, Walker, 1922; *apophyses du pont*, Chopard, 1920.)

Art, articulation (Pl. 16). Articulated connection between the separated basal and apical valves of the penis.

Ascl (Pl. 15). A pair of small sclerites situated laterally and internally to the proximal end of the apodemes; found only in Charilaidae.

Bf, basal or dorsal fold (Pl. 1, fig. 2). A fold formed by the ectophallic membrane, where, after junction with the cingulum, it extends distally, with the end turned upwards and backwards. Part of the fold sometimes bears sclerotised projections, or sclerotised plates, on the surface. Together with the ventral fold, the basal fold represents an adjustment, which allows the phallic organ to be pushed out and retracted. (*Basal fold*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Bp, basal valves of penis (Pl. 2). Proximal valves of the penis, when the latter is divided in two parts, or its proximal portion if it is undivided. (*Base of parameres* or *endoparameres* Walker, 1922; *endophallic plates*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Clf, cleft (Pls. 15, 16, 19, 23, 24, 28, 30). A slit-like ventral opening of the phallotreme where the endophallic membrane is continuous with the ectophallic, or with the rami, or with both. (*Vertical cleft*, Snodgrass, 1935; *slit-like phallotreme*, Snodgrass, 1937; *cleft*, Radclyffe-Roberts, 1941.)

Cd, discoidal cingulum. A disc-shaped sclerotisation located above the endophallus and derived from the ectophallic membrane. It is regarded here as the primitive, or rudimentary, cingulum.

Cng, cingulum. A secondary, usually strongly sclerotised structure derived from the ectophallus. It is a capsule or plate-like structure, or may be more complicated, consisting of apodemes, zygoma, rami and valves, sometimes forming the sheath of the endophallus. (*Cingulum*, Radclyffe-Roberts, 1941.)

Cr, crest on the dorsal surface of the spermatophore sac (occurs in *Euschiimidia* of Eumastacidae).

Cv, valves of cingulum (Pl. 2). A pair of valves projecting from the posterior end of the cingulum either dorsally (fig. 5) or ventrally (fig. 6) or from the arch of the cingulum (fig. 9). Morphologically derived from the ectophallus. Function: probably auxiliary to the apex of the penis. (Partly, *anterior, dorsal apical processes of aedeagus*, Snodgrass, 1935-37; partly, *dorsal valves of aedeagus*, Radclyffe-Roberts, 1941; *sclerites of dorsal lobe*, partly, Walker, 1922.)

Da, dorsal appendices of penis (Pl. 2, fig. 10). A pair of movable sclerites attached to the apical valves of the penis. Their function is probably auxiliary to that of the apical valves. Morphologically they are probably derived from the endophallus. (*Anterior dorsal apical processes of aedeagus*, partly, Snodgrass, 1935; *dorsal valves of aedeagus*, partly, Radclyffe-Roberts, 1941; *sclerites of dorsal lobe*, partly, Walker, 1922.)

Dpc (Pl. 19). A strongly sclerotised dorsal process at the proximal end of the cingulum.

Ect, ectophallus. External part of the phallic organ consisting mainly of the ectophallic membrane, cingulum and epiphallus, and the oval sclerites when these occur.

Ectm, ectophallic membrane. Membranous part of the ectophallus covering the phallic organ. It is continuous with the endophallic membrane.

Ects, ectophallic sclerites. All sclerites composing the ectophallus. (*Ectophallic sclerites*, Radclyffe-Roberts, 1941.)

Ectv, *ectophallic valves* (Pls. 4, 5). A pair of sclerotised valves representing a continuation of the ectophallic membrane and forming the apex of the aedeagus. The opening of the phallotreme is located between them. (Present in Eumastacidae.)

Ejd, *ejaculatory duct*.

Ejs, *ejaculatory sac*. Distal widening of the ejaculatory duct; situated mostly under the proximal part of the penis. Part of the endophallic sac.

End, *endophallus*. Internal part of the phallic organ, consisting of the endophallic sac, penis, and appendices.

Endm, *endophallic membrane*. The membranous part of the endophallus; continuous with the ectophallic membrane.

Endsa, *Endophallic sac*. Sac of the endophallus consisting of the ejaculatory sac, spermatophore sac and phallotreme.

Ends, *endophallic sclerites*. All the sclerites composing the endophallus; derived from the endophallic membrane. (*Endophallic sclerites*, Radclyffe-Roberts, 1941.)

Eph, *epiphallus*. A rather isolated, strongly sclerotised sclerite, located on the dorsal side of the phallic organ (except in Trigonopterygidae, where the whole phallic complex is in an inverted position). (*Epiphalle*, Chopard, 1920; *pseudosternite*, Walker, 1922; *epiphallus*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Et, *endophallic tube* (Pl. 14). A tube-like structure loosely covering the apical end of the endophallus (in *Proscopia*).

F, (Pl. 13). Fringe-like structures occurring on various parts of the phallus.

Fu, indicates the place of junction of parts of the phallic organ, severed by dissection.

Fuz, junction of the penis with the zygoxa.

Fx, *flexure* (Pl. 2, fig. 2). Flexible sclerotised part of penis connecting its basal and apical valves. (*Flexure*, Radclyffe-Roberts, 1941.)

G, *gonopore*. Connection between the ejaculatory and spermatophore sacs (*gonopore*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Gpr, *gonopore processes*. A pair of ventral processes from the basal valves of the penis. (*Gonopore processes*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Gprs, *gonopore sclerites* (Pl. 12). A pair of small sclerites at the distal end of the ejaculatory duct. Only found in Trigonopterygidae.

M, membranous parts of the phallic complex.

Mpo, membranous part of the pouch of the phallus.

Mu, sclerotised thickenings, probably for the attachment of muscles.

Op, distal opening of the phallotreme or of the aedeagus.

P, *penis* (Pl. 2, figs. 1-3). In most families consisting of a pair of elongated, separate (rarely partly fused) sclerites of the endophallus, but in some families, it is a single rod-shaped, arched or U-shaped sclerite. Derived from the endophallic sac. (*Aedeagus*, partly, Snodgrass, 1935; Radclyffe-Roberts, 1941; *penis*, Chopard, 1920; Walker, 1922, partly.)

Pal, *pallium*. A membranous continuation of the ectophallic membrane, connected with the walls of the genital chamber. At its distal end the pallium forms a fold partly covering the apex of the phallus, when not erected. (*Pallium*, Walker, 1922; Snodgrass, 1935; Radclyffe-Roberts, 1941; *capuchon inférieur*, Chopard, 1920.)

Phallic complex. The complex comprising the phallic organ and epiphallus. (*phallic organ*, Snodgrass, 1935; *phallic structure*, Radclyffe-Roberts, 1941.)

Phallic organ or phallus. The organ concerned with the accumulation of sperm and its transmission to the female genital chamber; it consists of the ecto- and endophallus. (*Phallic organ*, *phallus*, Snodgrass, 1935; *phallic structure*, Radclyffe-Roberts, 1941.)

Pht, *phallotreme*. Distal extension of the spermatophore sac, with an opening. (*Phallotreme*, Snodgrass, 1935 ; Radclyffe-Roberts, 1941.)

Po, *pouch of phallus* (Pl. 13). A pouch-like structure covering the proximal part of the endophallus. Found only in the genus *Systella* (Trigonopterygidae).

Rm, *rami of cingulum* (Pl. 1, fig. 2 ; Pl. 2, figs. 4-8). The lateral parts of the cingulum, sclerotised or membranous, extending from the dorsal part of the cingulum and sometimes connected ventrally. They sometimes form a sheath enveloping the apical part of the penis and forming the whole apex of the aedeagus, and are sometimes a membranous continuation of the ectophallic membrane, and indistinguishable from it. (*Valves inférieures*, Chopard, 1920 ; *lateral plates in the proximal part of the dorsal lobe*, Snodgrass, 1935 ; *rami of cingulum*, Radclyffe-Roberts, 1941.)

Scl, sclerites or sclerotised parts of the phallus which do not require special terminology.

Sclph (Pl. 13), sclerotised distal lobe of the phallotreme.

Sh, *sheath of penis* (Pl. 2, figs. 7-8). The sheath covering the apical part of the penis and sometimes forming the apex of the aedeagus ; it originates from the cingulum and appears as its distal continuation. It may be either strongly sclerotised or membranous and is sometimes fused with the ventral lobe. (*Sheath of aedeagus*, Radclyffe-Roberts, 1941 ; *outer membrane of distal part of dorsal lobe of aedeagus*, Snodgrass, 1935 ; *outer membrane of dorsal and ventral lobes*, Walker, 1922 ; *prepuce*, Chopard, 1920).

Sps, *spermatophore sac*. An extension of the ejaculatory sac, in most cases situated distally and partly dorsally to it. It is connected with the ejaculatory sac by the gonopore, and distally it extends to the phallotreme.

St, sclerotised projection fused with the wall of the ejaculatory sac (only in *Systella*, Pl. 13).

Th, a thickening of parts of the phallus of unknown significance.

Va, *ventral appendices of penis* (Pl. 2, fig. 11). A pair of valves analogous with the dorsal appendices of the penis, but attached below to the apical valves of it.

Ved, *valves of the ejaculatory duct* (Pl. 19). A pair of valves situated in the distal end of the ejaculatory duct before it widens into the ejaculatory sac.

Vf, *ventral fold* (Pl. 1, fig. 2). A fold formed by the ectophallic membrane on the ventral side. It is analogous with the basal or dorsal fold (**Bf**) and performs the same function. Apically, this fold sometimes extends into the ventral lobe.

Vinf, *ventral infold*. The ventral extension of the ectophallic membrane, sometimes indistinct. (*Ventral infold*, Radclyffe-Roberts, 1941.)

Vlb, *ventral lobe*. A lobe formed ventrally by the folding of the ectophallic membrane. It covers the basal part of the apical valves of the penis and the ventral part of the rami of the cingulum. It is sometimes fused below with the rami, and sometimes with the ventral walls of the phallotreme, contributing to the formation of the cleft. (*Ventral lobe*, Snodgrass, 1935 ; Radclyffe-Roberts, 1941 ; *subventral lobe*, Walker, 1922 ; *capuchon inférieur*, Chopard, 1920.)

Vpc, ventral posterior process of the cingulum (Pl. 10).

Zyg, *zygoma* (Pl. 1, fig. 2). A transverse dorsal part of the cingulum, connecting the apodemes and, in most cases, the cingulum itself with the apical valves of the penis. Morphologically it is not a separate sclerite but only an intermediate part. (*Zygoma*, Snodgrass, 1935 ; Radclyffe-Roberts, 1941 ; *arch of endophyses*, Walker, 1922 ; *pont postérieur*, Chopard, 1920.)

TERMINOLOGY OF THE PARTS OF THE EPIPHALLUS AND EXPLANATION
OF SYMBOLS USED IN THE PLATES.

(Pl. 3.)

A terminology of the main parts of the epiphallus, based on morphology, was proposed by Radclyffe-Roberts (1941), while Boldyrev (1929) proposed names for them based on their function. Neither terminology is adequate since it is not always possible to establish the homologies of the parts. The terminology given below is mainly that of Radclyffe-Roberts (1941), but with some modifications.

A, *ancorae*. A pair of processes or projections from the anterior margin or the dorsal surface of the epiphallus; sometimes they are articulated with the disc. (*Ancorae*, Radclyffe-Roberts, 1941; *anterior processes*, Snodgrass, 1935; *uplifting hooks*, Boldyrev, 1929.)

Ap, *anterior projections*. Projecting anterior ends of the lateral plates.

B, *bridge*. The middle part of the epiphallus connecting the lateral plates, or its lateral parts. (*Bridge*, Snodgrass, 1935; Radclyffe-Roberts, 1941.)

Disc, central part of the body of the epiphallus in the disc-shaped forms of the latter. In other forms it is a narrow bridge. Sometimes it is divided sagittally into two separate halves.

DA, *dorso-lateral appendices*. Additional lobes connected with the dorso-lateral parts of the anterior end of the epiphallus. Found only in the Pyrgomorphidae.

L, *lophi*. Processes on or near the posterior end of the epiphallus, sometimes arising from the lateral parts of the bridge, sometimes from its lateral plates. They are very variable in shape. (*Lophi*, Radclyffe-Roberts, 1941; *posterior processes of epiphallus*, Snodgrass, 1935; *postcornua* or *processes of pseudosternite*, Walker, 1922; *depressors*, Boldyrev, 1929.)

Lp, *lateral plates*. A pair of symmetrical plates, forming the sides of the epiphallus, sometimes connected with the bridge only by membrane. (*Lateral plates*, Radclyffe-Roberts, 1941; *lateral lobes*, Snodgrass, 1935.)

Lscl, *lateral sclerite*. Sclerite of unknown significance. (Occurs in *Erucius* of Eumastacidae.)

Mp, *median projection*. A projection from the middle of the anterior margin of the epiphallus.

Ms, *median slit*. A slit which divides the epiphallus sagittally into two halves, connected only by membrane.

Os, *oval sclerites*. A pair of small sclerites, circular, oval or irregular in form, located laterally to the epiphallus. (*Oval sclerites*, Snodgrass, 1935; *lateral sclerites*, Radclyffe-Roberts, 1941.)

Pp, *posterior projections*. Posterior ends of the lateral plates, which sometimes project strongly.

VA, *ventro-lateral appendices*. Irregularly shaped, weakly sclerotised lobes, connected with the ventro-lateral part of the anterior margin of the epiphallus (in the Charilaidae only).

Vscl, *ventral sclerite of epiphallus*, of unknown significance. (Occurs in *Erucius* of Eumastacidae.)

GENERAL STRUCTURE OF THE PHALLIC COMPLEX.

The whole phallic complex, when removed from the genital cavity, is a stout, strongly sclerotised body. The apical end is directed towards the

posterior end of the body, except in Trigonopterygidae in which it is directed towards the anterior end (Pl. 12, fig. A).

On the dorsal surface of the phallic organ is the epiphallus, which arises from the ectophallic membrane; it is described separately below (p. 232). The structure of the phallic organ is as follows. The ejaculatory duct widens apically to form the endophallic sac; it curves upwards at its distal end and continues as the ectophallus, which covers the endophallus externally and is connected at the proximal end with the internal surface of the body wall. Usually the ectophallus and endophallus are modified, and sometimes very strongly, with sclerotisations of various forms and other, sometimes complicated, structures.

Examples of the phallic organ in its most primitive form are found in some of the Eumastacidae and Pneumoridae. They possess a very simple endophallus, consisting of the endophallic sac hardly differentiated into the ejaculatory and spermatophore sacs, while the penis is simply a thickening of the walls of the endophallic sac; the ectophallus is merely sac-like, sometimes with sclerotised parts. In groups that are more specialised, the ectophallus is more sclerotised and gives rise to structures such as a rudimentary plate-like cingulum and the valves which form the apical end of the aedeagus, while the endophallic sac is distinctly differentiated into the ejaculatory and spermatophore sacs and the penis is more sclerotised.

In the highly specialised groups, the structure of the phallic organ is as follows. The ectophallus is differentiated into the ectophallic membrane and sclerotised cingulum. The ectophallic membrane, which may be either very thin or partly sclerotised, completely or partly covers the phallic organ. Internally, the membrane is connected, or sometimes partly fused, with the cingulum. Sometimes, when the cingulum is not fully differentiated from the membrane, the whole ectophallus is in the form of a more or less sclerotised capsule covering most of the phallic organ (Pl. 19). When not fused with the cingulum, the ectophallic membrane joins it in the region of the zygoma and rami; from this junction the membrane extends distally, then turns in the proximal direction and forms the basal or dorsal fold (Pl. 1, fig. 2). Laterally, the membrane is connected with the rami of the cingulum. Ventrally, it sometimes forms a ventral fold, the apical part of which (ventral lobe) may partly cover the basal part of the apical valves of the penis and the ventral part of the rami (Pl. 32). Sometimes this fold is joined to the margins of the ventral slit of the phallotreme and participates in the formation of the cleft (Pl. 28). Sometimes, in forming the cleft, this junction is combined with the ventral edges of the rami (Pl. 32). When not forming the ventral fold, the membrane is fused ventrally with the rami. The membrane may also form the ventral infold (Pl. 1, fig. 2), a thin invagination which is sometimes short and indistinct.

The cingulum is usually strongly sclerotised and consists of a pair of elongated sclerites or apodemes which are normally located dorsally, and may be strong, thick and rod-like, or broad and lobiform, or narrow and weak. Nearly always, the apodemes are joined together at their proximal ends by a transverse, usually bar-like, zygoma, which may be more or less sclerotised and is sometimes very broad, but usually narrow. The rami are either separate or fused ventrally; sometimes they form, together with the zygoma and part of the

apodemes, a capsule-like covering to the apical part of the endophallus (Pl. 2, figs. 7, 8). They are usually sclerotised, but sometimes thin and membranous. The extension of the rami, covering the apical part of the penis, is called the sheath and sometimes functionally represents the aedeagus (Pl. 2, fig. 8). The zygoma of the cingulum is sometimes joined with a small sclerite, the arch of the cingulum. Sometimes the zygoma is connected directly with the apical, rarely with the basal, valves of the penis. From the zygoma region of the cingulum (Pl. 2, fig. 5) or from the arch (Pl. 2, fig. 9) there often arises a pair of valves, situated above the penis valves and parallel to them. Snodgrass (1935) and Radclyffe-Roberts (1941) called them the dorsal valves of the aedeagus, but they actually belong to the cingulum. On the ventral side of the cingulum the extensions of the rami sometimes also bear a pair of ventral valves, parallel to the apical valves of the penis (Pl. 2, fig. 6). In such cases the real valves of the penis may be incorrectly regarded as the valves of the cingulum and the ventral valves of the cingulum mistaken for the valves of the penis.

The endophallus consists of the endophallic sac and the penis which is derived from it. The penis may be of the following five types: a single rod-like sclerite; a single sclerite, forming an arch or U-like structure; a pair of rod-like valves; a pair of valves, each divided into two parts, apical and basal, but connected by the flexure; sometimes the flexure almost disappears, and sometimes it tends to thicken; and a pair of valves, each completely divided into a basal and an apical part (Pl. 2, figs. 1-3). The apical valves of the penis are usually upcurved and are sometimes of complicated shape. They may have movable appendices on the dorsal or the ventral side (Pl. 2, figs. 10, 11). The basal half of the penis (basal valves) is in most cases widened, sometimes forming complicated lobes. On the ventral side of the sclerites of the penis, there may be a pair of gonopore processes, which partly separate the ejaculatory sac from the spermatophore sac. The ejaculatory sac is situated ventrally to the penis valves or partly between them, and the spermatophore sac may be either ventral, dorsal or partly between them.

The endophallic sac is a continuous chamber comprising the ejaculatory sac and the spermatophore sac, which are sometimes clearly delimited by a constriction so that the gonopore, which connects them, is clearly recognisable; but in some groups they are virtually a single sac with little or no constriction. When gonopore processes are present they serve to indicate the division of the endophallic sac, even in the absence of a constriction, but when they are absent and there is no constriction, the division is merely conventional. The spermatophore sac continues to the phallotreme, which has an opening apically; sometimes there is a slit-like extension of the opening ventrally and sometimes a dorsal extension also. The edges of the ventral slit-like extension, when this occurs, are continuous with the ectophallic membrane or the ventral edges of the rami of the cingulum or both, and sometimes forms the cleft. The cleft, if present, may be long or short, depending on the length of the phallotreme; sometimes, when the spermatophore sac is dorsal, the cleft may begin from the distal end of the ejaculatory sac (Pl. 16). The cleft is longest in Pamphagidae (Pl. 16), shorter in Pyrgomorphidae (Pl. 19) and Charilaidae (Pl. 15) and shortest in the majority of Acrididae. It is generally short in Catantopinae, but in some genera of that subfamily it is almost as long as in Pamphagidae. In Acridinae and Truxalinae it is absent.

THE EPIPHALLUS.

The epiphallus represents a part of the phallic complex which is rather isolated from the other parts and has a special auxiliary function. It is a strongly sclerotised structure differing in relative size and shape in different groups and situated on the dorsal side of the phallic organ (except in Trigonopterygidae). Its postembryonic development was studied in *Acrida* sp., *Tmethis* sp., *Phymateus* sp., *Locusta migratoria migratorioides* (R. & F.) and *Schistocerca gregaria* (Forsk.). In the last nymphal stage, it is only slightly sclerotised and is not of the shape to be found in the adult. After the final moult, it acquires its characteristic shape, but for some time it remains soft and some of its parts have indefinite edges. At the time of sexual maturation it becomes a mainly hard, thick structure.

There are two principal forms of epiphallus: a rather simple plate, often shield-like (Pl. 3, figs. 4, 5, 6, 9) and a more complicated bridge-like form (Pl. 3, figs. 1, 2, 3, 7, 8, 10). The bridge may be broad or narrow, and is sometimes interrupted in the middle so that the epiphallus is divided into two parts (Pl. 3, fig. 3). The lateral plates are sometimes connected with the bridge by a membrane (Ommexechidae, Pl. 3, fig. 10). Anteriorly, the disc of the epiphallus bears, in most cases, a pair of projections or ancorae, which vary in shape and size. Posteriorly, almost all bridge-shaped epiphalli bear another pair of projections, the lophi (Pl. 3, figs. 1, 3, 7, 8); these vary greatly in shape, and may be tooth-shaped, hook-shaped, finger-shaped, lobiform or tubercle-like. They are absent in all shield-shaped epiphalli. The lateral plates are extensions of the disc or bridge and may be of various forms, more or less distinct, or absent; they occur in both types of epiphallus. The anterior and posterior ends of the lateral plates usually form more or less strongly developed projections, sometimes of characteristic form. The disc, lateral plates, ancorae, and lophi, of the epiphallus are in most cases curved (Pl. 1, figs. 3, 4) and the whole epiphallus, seen in profile (Pl. 1, fig. 5), is strongly curved. Some epiphalli possess lateral appendices, dorsal (Pl. 3, fig. 2) or ventral (Pl. 3, fig. 4), which are sometimes strongly sclerotised and of very definite shape, but sometimes weak and continuous with the muscular tissue.

Near the sides of most bridge-shaped epiphalli (but not in Pyrgomorphidae), there is a pair of oval or irregularly shaped, small sclerites which serve for the attachment of muscles (retractors of the phallus, Snodgrass, 1935). In most Acridids, these sclerites are quite distinct from the epiphallus, but in Ommexechidae (Pl. 3, fig. 10) and Lathiceridae the oval sclerites are very close to the epiphallus and may be regarded as a part of its structure. It is possible that the lateral appendices of Pyrgomorphidae and Charilaidae are homologous with the oval sclerites.

FUNCTIONS OF THE PARTS OF THE PHALLIC COMPLEX.

Little is known about the function of the parts of the phallus owing to the absence of direct observations. However, some conclusions may be drawn from their structure. The whole organ serves a dual purpose: firstly, it serves for the accumulation of the sperm and of the secretions of the genital glands, and for the formation of the spermatophores; and secondly, for the transfer of the spermatophore into the female genital chamber.

The sperm from the ejaculatory duct passes into the ejaculatory sac, and then into the spermatophore sac; this may be regulated by lateral movements of the valves of the penis, which are, in most cases, movable and may compress the gonopore. The sperm and the secretions in the spermatophore sac form the spermatophore. The lengthened neck of the spermatophore is probably formed in the phallotreme, or in the narrow space between the apical valves of the penis or the valves of the aedeagus. The transfer of the spermatophore from the phallus to the genital chamber of the female is probably achieved by the active movement of the movable parts of the penis, as well as by compression of the sac. This compression may be partly muscular and partly the result of the blood pressure, since the whole phallus is filled with blood in the erected position (Pl. 1, fig. 2) and greatly swollen.

The basal and ventral folds, if present, permit the whole body of the phallus to be pushed out (the folds then disappearing) or drawn in.

With regard to the function of the epiphallus, several suggestions have been made, differing only in details. Boldyrev (1929), Radclyffe-Roberts (1941), Omachi (1950) and the present writer agree that the epiphallus serves to grasp the edge of the female subgenital plate and to fix the phallus firmly during copulation. The grasping function is performed by the lophi (or the teeth, spines or ridges in the case of the shield-like epiphallus), while the fixing is achieved by the ancorae, or, when these are absent, the anterior margin of the epiphallus, pressing against the male supra-anal plate or, in some cases, against the dorsal surface of the phallus.

Family EUMASTACIDAE.

In his recent revision of the family Eumastacidae Rehn (1948) recognised 17 subfamilies; since then, the subfamily Tanaocerinae has been raised to family rank (Dirsh, 1955).

Because of the rarity of some representatives of this family, the phallic complex of only six subfamilies was studied.

The general features of the phallic complex common to the whole family are as follows:

Ectophallus relatively large, mainly membranous, sac- or capsule-like, often with sclerotised structures, such as spines and teeth, but these not forming a cingulum similar to that of Acrididae.

Endophallus very simple, sometimes relatively very small; ejaculatory sac small and simple; opening of ejaculatory duct in most cases located on dorsal side of ejaculatory sac. Penis, in most cases, a simple arch- or U-shaped sclerite; sometimes sclerotisation so weak that penis may be regarded as a mere thickening of walls of endophallic sac; sometimes it is absent altogether.

Epiphallus of varying shape, with strongly sclerotised lophi and usually with a weak membranous disc; ancorae absent, but sometimes there are other sclerotised structures, which are difficult to compare with any known structure in the epiphalli of Acrididae; edges of epiphallus often indistinct, merging gradually with ectophallic membrane. Oval sclerites absent.

Amongst the studied subfamilies of Eumastacidae, the Gomphomastacinae, Biroellinae and Morabinae possess certain common characters, which allow them to be placed in one group. All representatives of these subfamilies

studied have a similar sac- or capsule-like membranous ectophallus; a rather large endophallic sac with the end of the ejaculatory duct attached to it on the dorsal side; and a simple, one-piece, arch-shaped penis, which might be regarded as a thickening and weak sclerotisation on the walls of the sac. Each of the other three subfamilies studied has distinctive characters, and this makes it difficult to connect them with the first group and with one another, but the general character remains characteristic for the family. The genus *Eus Schmidia*, in particular, possesses a more advanced type of penis which resembles that of Acrididae more than is the case in other subfamilies studied.

It might be concluded that the phallic complex in Eumastacidae is rather variable, suggesting a very early differentiation of subfamilies. On the whole it is simpler than in the Acrididae and other families, but sometimes with a high specialisation of certain parts (e.g. the ectophallus of *Erucius*).

The relations of Eumastacidae to other families on the basis of their phallic complex is rather obscure since they are so different. Only in the family Pneumoridae is the same, very simple, phallic complex found, but the Pneumoridae are very different in other respects. It is impossible at present to discuss the interrelation of Eumastacidae with Tanaoceridae and Xyronotidae, in which the phallic complex (except the epiphalli) remains unstudied.

Subfamily GOMPHOMASTACINAE.

Only one genus, *Gomphomastax* Brunner, and two species, *G. clavata* (Ostroumoff) and *G. antennatus* Brunner, were studied.

Gomphomastax clavata (Ostroumoff, 1881) (Pl. 4).

Ectophallus thin, membranous, forming a sac-like structure covering the whole endophallus, and ending in a pair of triangular sclerotised ectophallic valves, forming apex of aedeagus; opening of phallotreme lying between bases of these valves; at base of valves, ectophallic membrane forming a dorsal or basal fold and a ventral fold; a pair of slightly sclerotised lateral lobes are present.

Endophallus consisting of a large endophallic sac, with a large ejaculatory sac and collapsible spermatophore sac, with dorsal folds; phallotreme short and broad, with sclerotised margins, connected with base of ectophallic valves. Penis simple, of horse-shoe shape with acute apices directed posteriorly, not reaching margins of phallotreme opening; it is rather weakly sclerotised and might be regarded as a thickening of walls of endophallic sac. Ejaculatory duct opening on dorsal side of ejaculatory sac.

Epiphallus comparatively strongly sclerotised, with strong hook-shaped lophi and short, bridge-shaped disc; lateral edges of disc, at base of lophi, gradually merging into membrane.

Subfamily BIROELLINAE.

The only genus in this subfamily is *Biroella*, and two species, *B. gracilis* C. Bolivar, 1925, and *B. papuana* C. Bolivar, 1925, were studied.

In all its principal parts the phallic complex of *Biroella* is similar to that of *Gomphomastax*; both have a sac-like ectophallus, a strongly arched penis, a comparatively large endophallic sac and a similarly shaped epiphallus. This suggests that the two subfamilies are rather closely related.

Biroella gracilis C. Bolivar, 1925 (Pl. 5).

Ectophallus thin, membranous, forming a sac- or capsule-like structure covering the whole endophallus; ending in a pair of sclerotised triangular, subacute ectophallic valves, forming apex of aedeagus, with opening of phallotreme between their bases; in basal part of dorsal side of these valves there is a pair of large acute strongly sclerotised teeth directed internally; at base of valves, in middle of ventral side, a weakly sclerotised lobe; at the base of valves, ectophallic membrane forming a basal or dorsal fold and a ventral fold.

Endophallus consisting of a large endophallic sac, with large ejaculatory sac; spermatophore sac large, with phallotreme rather long and narrow; its margins connected with base of ectophallic valves. Penis thin, arched, with acute apices, and rather weakly sclerotised; might be regarded as a thickening of walls of endophallic sac. Ejaculatory duct connected with ejaculatory sac on dorsal side.

Epiphallus arched, with strongly sclerotised, hook-shaped lophi; its disc short, arched, strongly sclerotised, with an additional elongated, weakly sclerotised plate attached to anterior margin.

Subfamily MORABINAE.

This subfamily was only recently placed in the family Eumastacidae (Rehn, 1948). Although very peculiar in external appearance, the Morabinae are similar to the Gomphomastacinae and Biroellinae in the structure of the phallic complex.

Two genera, *Moraba* and *Callitala*, were studied and they were found similar in all main characters.

Moraba sp. (Pl. 6).

Ectophallus membranous, forming a sac- or capsule-like structure covering the whole endophallus; its apical part is sclerotised and ends in a pair of large teeth on the dorsal side and in a pair of smaller teeth and two pairs of lobes on the ventral side; they form the aedeagus, and the sclerotised end of phallotreme is located between them; at the base of the sclerotised apical part, the ectophallic membrane forms a basal or dorsal fold and a ventral fold which is produced in front of the apex of aedeagus.

Endophallus consists of a rather large endophallic sac, large ejaculatory sac and spermatophore sac with undifferentiated phallotreme. Margins of the phallotreme opening bear a pair of sclerotised curved lobes and a membranous upper lobe. Weakly sclerotised penis represents a very simple, elongated, thin arch and might be regarded as a thickening of the walls of the endophallic sac. Ejaculatory duct is connected with the ejaculatory sac on the dorsal side of it.

Epiphallus disc-shaped, weakly sclerotised, with a pair of strongly sclerotised, large, teeth-like upcurved apical projections in the middle of the posterior margin.

Subfamily CHOROTYPINAE.

Two genera, *Chorotypus* and *Erianthus*, of this subfamily, as represented by *Ch. gallinaceus* (Fabricius, 1793) and *E. guttatus* (Westwood, 1841), were studied; their phallic complexes were found similar in their main features.

The phallic complex of the Chorotypinae differs strongly from that in the three subfamilies described above. The sclerotised ectophallus, the position of the endophallic sac, the location of the opening of the phallotreme and the structure of the epiphallus represent such divergent features that it is hardly possible to connect the Chorotypinae with other Eumastacidae.

Erianthus guttatus (Westwood, 1841) (Pl. 7).

Ectophallus strongly sclerotised, its apical half forming a capsule-like structure with numerous teeth, lobes and projections; it has no apical opening and encloses a comparatively large ejaculatory sac; basal half consisting of a pair of sclerotised elongate plates, superficially similar to basal valves of penis in Acrididae.

Endophallus consisting of large ejaculatory and spermatophore sacs, the former located in ectophallic capsule, the latter above plates of ectophallus. Phallotreme short, its opening between lophi of epiphallus. Ejaculatory duct connected ventrally with ejaculatory sac. No trace of a penis, or other sclerotisation in endophallus.

Epiphallus of unusual form, mushroom-like, with a two-branched basal structure, each branch ending in a robust process curved at an acute angle with numerous teeth at apex; these branches are regarded here as lophi, but they may be parts of ectophallus.

Subfamily ERUCIINAE.

The phallic complex was studied in the genera *Erucius* and *Prionocantha*, and was found to be very similar in these two genera and very different from those of other subfamilies of Eumastacidae.

The main characters of the subfamily are the large, soft, membranous ectophallus, bearing numerous strongly sclerotised teeth; the very small endophallus with strongly sclerotised, arched penis, and a very characteristic epiphallus.

Erucius dimidiatipes I. Bolivar, 1898 (Pl. 8).

Ectophallus large, thin, membranous, forming a sac-like structure, which can be extended forwards or drawn in; on dorsal side of ectophallus, a pair of large, strongly sclerotised teeth in the middle of basal part; at apical end a row of smaller teeth located around opening of aedeagus; and ventrally a pair of bar-like sclerites, which bear a strong tooth at each end.

Endophallus extremely small compared with ectophallus, consisting of a very simple endophallic sac with a comparatively large ejaculatory sac and a small, poorly differentiated, spermatophore sac continued into a short, broad phallotreme. Penis comparatively strongly sclerotised, small, arched, in dorsal view with double S-curved valves, in lateral view with plate-like broadened basal half. Ejaculatory duct is connected with ejaculatory sac dorsally.

Epiphallus in the form of a large, almost square, plate with its anterior margin merging into membrane and with strongly sclerotised posterior margin bearing laterally a pair of large tooth-like projections; epiphallus continuous ventrally with another sclerotised plate; laterally, there is a pair of large sclerotised, arched appendices, distal ends and external margins of which merge gradually into ectophallic membrane. (Whether this structure corresponds with the epiphallus of Acrididae or might be regarded as a different kind of sclerotisation of the ectophallic membrane, is an open question.)

Subfamily EUSCHMIDTIINAE.

The phallic complex of only one genus, *Euschmidtia*, of this subfamily was studied. It differs from that in other studied subfamilies of Eumastacidae in the strongly developed penis which is similar to that found in Acrididae; its apical ends are connected, whereas in other Eumastacidae the basal ends are connected.

Euschmidia burri Uvarov, 1953 (Pl. 9).

Ectophallus large, weakly sclerotised, forming a simple capsule-like structure; edges of ventro-apical opening sclerotised and undulating.

Endophallus, compared with ectophallus, very small. Penis strongly sclerotised, with strongly widened plate-like basal parts which resemble basal valves of penis in Acrididae; its apical parts thin and narrow, and connected at apex. Endophallic sac consisting of ejaculatory sac, which is so small that it might be regarded merely as an expansion of the ejaculatory duct; it is located on dorsal side, anteriorly to spermatophore sac at point of junction with phallotreme. Spermatophore sac comparatively very large with thick walls and lateral expansions and a high, strongly sclerotised crest along the middle. Phallotreme comparatively narrow, located above apical parts of penis; on its dorsal side, a small longitudinal sclerite, which may possibly control flow of sperm from ejaculatory sac into spermatophore sac and its passage through phallotreme.

Epiphallus consisting of a thin, weakly sclerotised, longitudinal disc, with a pair of narrow, strongly sclerotised, undulating bars running along the sides; at apex they end in a pair of large, robust, incurved hooks.

Family TANAOCERIDAE (Pl. 11, fig. 1).

The phallic complex of this family was not studied, except for the epiphallus of *Tanaocerus koebele* Bruner, 1906.

Epiphallus of discoidal shape without ancorae and lophi, but with well developed lateral plates; the internal margins of the plates produced as a pair of long, thin hooks which are directed inwards and forwards; along the internal side of each lateral plate there are three small, strong teeth; oval sclerites absent.

Family PNEUMORIDAE (Pls. 10; 11, figs. 5-8).

The phallic complex of four genera, *Bullacris* Roberts, 1941, *Physemacris* Roberts, 1941, *Pneumora* Thunberg, 1775 and *Shortridgea* Péringuey, 1916, was studied. In all of them, it was found to be rather uniform in all its main parts, except the epiphallus which is similar in the genera *Physemacris* and *Bullacris* but very different in the other two genera *Pneumora* and *Shortridgea*, which are similar to one another in this respect (see Pl. 11, figs. 5, 6 and figs. 7, 8).

The main characters for the whole family are:

Ectophallus very simple, sac-like, which in the basal half, on the dorsal side, forms a weakly chitinised discoidal sclerite which possibly represents a rudimentary type of cingulum. Endophallus very simple; endophallic sac of simple tube-like formation, hardly differentiated into ejaculatory and spermatophore sacs. Penis is represented by a pair of bar-like sclerotisations of walls of endophallic sac. Epiphallus shield-like, without ancorae, lophi and oval sclerites.

The phallic complex of Pneumoridae, owing to its simplicity, may be compared only with that of Eumastacidae, but the presence of a rudimentary cingulum puts this family in a more advanced position. The differences in other characters do not, however, permit one to regard the two families as closely related.

Physemacris variolosa (Linné, 1758) (Pl. 10).

Ectophallus thin, membranous, forming a sac-like structure; its apical end weakly sclerotised and forming a bulb-like inflation, which represents end of aedeagus; the whole structure can probably be inflated and expanded or shrunk. At base of dorsal side, ectophallic membrane forms a weakly sclerotised disc with broad lateral lobes; this disc is similar to the cingulum in Acrididae and is probably its rudiment.

Endophallus a tube-like sac with a slight broadening in the base, into which ejaculatory duct opens; this part might be regarded as the ejaculatory sac; its immediate continuation representing the spermatophore sac, and opening at the aedeagus without forming a distinct phallotreme. Walls of endophallic sac forming a pair of sclerotised, longitudinal, rod-like thickenings which doubtless represent a primitive penis.

Epiphallus discoidal, without ancorae and lophi, but with three median projections; lateral plates distinct, with posterior projections; oval sclerites absent.

Both *Physemacris* and *Bullacris* have the same type of epiphallus (Pl. 11, figs. 5, 6.)

The genera *Pneumora* and *Shortridgea* both possess a discoidal epiphallus, but with a tendency to form a bridge and ancorae, without lophi and with the dorsal surface covered densely with small teeth; oval sclerites also absent (Pl. 11, figs. 7, 8).

Family XYRONOTIDAE (Pl. 11, fig. 2).

The phallic complex of this family, which consists of a single genus and species, *Xyronotus aztecus* I. Bolivar, 1884, was not studied, except for the epiphallus. Radelyffe-Roberts (1941) pointed out that the phallic complex of *Xyronotus* does not resemble that in any of the subfamilies studied by him. Kevan (1952) noted that *Xyronotus* has a well developed cingulum, which, according to his figure, is of discoidal, primitive form.

Epiphallus of discoidal form, with a tendency to form a bridge; finger-shaped projections on anterior part, covered with small ridges, might be regarded as ancorae; lophi absent; lateral plates distinct; oval sclerites absent.

It is difficult with such incomplete data to place the family in its appropriate position and it is possible only to suggest that it is remotely related to the Pneumoridae.

Family TRIGONOPTERYGIDAE (Pls. 12, 13; 11, figs. 3, 4)

The family Trigonopterygidae was first established by Walker (1870). Later authors (I. Bolivar, 1884, 1905, 1909; Kirby, 1910) regarded the genera belonging to it as members of the subfamily Pyrgomorphinae, but, in 1952, this group was regarded by Dirsh as the subfamily Trigonopteryginae. The present detailed study of the phallic organ makes it necessary to raise it to the rank of a family.

The most striking character of the family is the reversal of the whole phallic complex through 180°, so that the apex of the penis is directed forwards (Pl. 12, fig. A) instead of backwards, as in all other families. All parts of the phallic complex occupy a correspondingly reversed position, e.g. the apodemes and zygoma are ventral. There are also many other peculiar characters of the phallic complex which do not occur in the other families.

Kevan (1952) divided the Trigonopterygidae into three tribes: Trigonopterygini, Borneacridini and Xyronotini. The last he regarded as "temporarily attached to the Trigonopteryginae", but it has recently been made an independent family (Dirsh, 1955). The two genera of the first tribe, *Trigonopteryx* and *Systella*, are so different in the phallic complex that it is necessary to describe it for both of them; the main family characters, however, viz. the reversed position of the complex and the form of the epiphallus, are common to both.

The tribe Borneacridini Kevan, 1952, was not studied, but the shape of the epiphallus as figured by Kevan (*l.c.*) is similar to that in the Trigonopterygini. (figs. 3-6 in Kevan's work are drawn upside down).

Trigonopteryx hopei (Westwood, 1841) (Pl. 12; Pl. 11, fig. 3).

Phallic complex when extracted from insect is an oval body, almost completely covered by ectophallic membrane; only apices of apical valves of penis projecting forwards. Epiphallus located ventrally, below apices of apical valves of penis, at anterior end of phallic organ. Apodemes and zygoma of cingulum situated on ventral side. Apodemes of unusual form, short, broad and widening distally. Zygoma narrow, joined to apical valves of penis by a membrane. Rami membranous, appearing as a direct continuation of ectophallic membrane. Apical valves of penis rather short, strong, with distal ends slightly decurved, their proximal ends situated between anterior ends of basal valves, but completely separated from them. Basal valves of penis with unusually strongly developed anterior and posterior lobes. The most characteristic structure, not occurring in other families, is a pouch-like formation (*Po*) completely covering posterior part of basal valves of penis (Pl. 12, fig. II), and having sclerotised walls, divided below by a suture, and bearing a pair of strongly sclerotised dorsal ridges (*Scl*) connected by membrane; whole pouch lying loosely on basal valves of penis (Pl. 12, fig. II, normal position) and movable upwards (see Pl. 12, fig. I), attached to basal valves by thin membrane (*Mpo*), which (Pl. 12, fig. II) is normally folded inwards but unfolds when pouch is raised (Pl. 12, fig. I). (It is difficult to decide whether this pouch is of ecto- or endophallic origin; superficially it resembles the dorsal pouch of the phallus of some Gryllidae (Snodgrass, 1937)).

Ejaculatory duct passing below and behind body of phallus, then turning backwards and opening on dorsal side of basal valves of penis. Below opening, walls of ejaculatory sac widened and thickened, bearing a pair of small lateral sclerites analogous to, and probably homologous with, gonopore processes, but completely separated from body of basal valves of penis. Ejaculatory sac situated posteriorly to opening of ejaculatory duct (Pl. 12, fig. m, endophallus figured in section). Spermatophore sac small, situated anteriorly to opening of ejaculatory duct, and indistinguishable from the short phallotreme. Both sacs located between basal valves of penis.

Epiphallus shield-like, with broad, indistinct ancorae; lophi absent; anterior projections indistinct, posterior ones well developed; laterally there are two irregular groups of small teeth. Oval sclerites absent.

On one occasion a structure was found at the end of the aedeagus; after soaking in water it appeared to be a spermatophore. It consisted of a mucous mass with a small reservoir inside, from which a narrow tube protruded (Pl. 12, fig. N).

Systella rafflesii Westwood, 1841 (Pl. 13; Pl. 11, fig. 4).

This species has the same reversed phallic complex as *Trigonopteryx*. The epiphallus is of the same shield-like form, but all the other characters are very different.

Dorsal side of phallus covered by ectophallic membrane, which has a pair of lateral sclerotised plates; only ends of apical valves of penis and sclerotised distal lobes of phallotreme remain uncovered. Basal fold on ventral side well developed. Epiphallus located below on distal end of phallic organ. Apodemes widely divergent and comparatively narrow. Zygoma large, elongated and firmly attached to apical valves of penis and to lower appendices of aedeagus, which may be regarded as valves of cingulum. There are three of these appendices, forming with apical valves of penis a definite unit; their morphological interrelations are difficult to determine. Rami of cingulum soft, membranous, and continuous with ectophallic membrane. Endophallus of complicated form. Basal valves of penis are a pair of thick, broad, oval plates, connected with each other and with apical valves of penis by a small, bridge-like sclerite; in middle of external side of each, a small, projecting corrugated sclerite, probably for attachment of muscles. Apical valves of penis are a pair of semi-circularly curved sclerites, to which are attached below three sclerotised valves, connected with one another and with apical valves of penis by membrane; this membrane together with apical valves of penis and appendices, forms a rather large chamber, which opens distally between appendices and above between apical valves of penis (in Pl. 13, fig. J, it is shown by dotted line); this chamber (Pl. 13, figs. K, H) wholly inserted into the elongated, broad, ventral opening of phallotreme. (The function of this chamber is not clear; it may take part in forming or storing a spermatophore. Morphologically, the whole structure, except for the apical valves of penis, is of ectophallic origin and may be analogous or even homologous, to the valves of the cingulum of other groups.) Ejaculatory duct passing below anterior end of phallus, between basal valves of penis, turning upwards and opening on dorso-posterior part into ejaculatory sac, which is situated on dorsal side of phallus. Ejaculatory sac small, with very thick sclerotised walls. Behind it, there is a long, narrow, strongly sclerotised projection, with fan-like corrugated lobes; this projection (except for a small part of the lobes, which may be seen from dorsal side of phallus) is located between basal valves of penis (Pl. 13, fig. I). Spermatophore sac large and located between basal valves of penis. Phallotreme long and broad, with a broad opening along whole length ventrally, into which aedeagal chamber is partly inserted. Apex of phallotreme ending in a pair of curved sclerites derived from the membrane of phallotreme.

Epiphallus shield-like, with distinct ancorae; lophi absent; anterior projections distinct; posterior ones indistinct; centre of the disc with a group of small teeth. Oval sclerites absent.

Family PROSCOPIIDAE.

The phallic complex in this family is very different from that of others (if the only species studied is typical for the whole family). The endophallus presents a mixture of primitive features (shape of sac and penis) and specialised ones (endophallic tube). The ectophallus forms a cingulum of unusual structure, less specialised than in the Acridoid group of families.

Proscopia scabra Klug, 1820 (Pl. 14).

Ectophallus thin, membranous, forming a cingulum. In its basal half, cingulum soft and sac-like, enveloping apical part of endophallus; in its apical half, it forms a pair of large triangular valves joined at apex, and lined internally and connected below by thin membrane. Basally, on dorsal side of cingulum, there is an additional discoidal sclerite (*Cd*) which might be regarded as a rudiment of sclerotised parts of cingulum (zygoma, apodemes) of other families.

Endophallus elongate, curved, tube-like. Ejaculatory sac very small, soft; it may be regarded as a widening of base of ejaculatory duct; spermatophore sac narrow, tube-like, with soft, membranous dorsal wall and strongly sclerotised, thick ventral wall. This sclerotisation is probably a primitive form of penis, but it might be the result of fusion of

two valves of a more advanced type of penis, its simplicity being secondary. No distinct phallotreme, but whole apical part of spermatophore sac loosely covered by a wide, strongly sclerotised tube, the significance of which is obscure. Edges of opening of spermatophore sac connected with edges of tube internally. Apical end of endophallus located on dorsal side between bases of valves of cingulum.

Epiphallus bridge-shaped, with strong, hook-shaped lophi. Oval sclerites absent.

Family CHARILAIIDAE (Pls. 15 ; 27, figs. 1-3).

Only three genera with five species are known in this group, which has recently been given subfamily rank (Dirsh, 1953), and is now regarded as a family. The phallic complex of two genera and three species was studied and found to be very similar in all the principal characters.

The phallic complex of Charilaidae is quite unique and most complicated in structure. The divided penis and shield-like epiphallus are common to the Charilaidae and Pamphagidae, but the Charilaidae differ strongly in the presence of ventro-lateral appendices of the epiphallus, the absence of zygomata and rami, separated apodemes, the presence of the arch of the cingulum and the markedly dorsal position of the spermatophore sac.

Charilus carinatus Stål, 1875 (Pls. 15 ; 27, fig. 2).

Ectophallic membrane is sclerotised posteriorly, and basal fold strongly produced distally, with a pair of sclerotised lateral projections and also a ventral lobe deeply excised distally; edges of excision being continuous with phallotreme, forming short cleft. Cingulum consisting of a pair of robust, strongly sclerotised apodemes, not connected in zygomata region, but curving downwards and joining ventral part of arch of cingulum; they are connected posteriorly by a transverse bar (in the genus *Charilus* only). Zygomata absent, but in its place, on internal side of apodemes, a pair of small but robust sclerites connected with apodemes, but not with each other. Rami are completely absent. Arch of cingulum connected proximally with both branches of apodemes and forming distally two pairs of complicated cingular valves, which represent the functional apex of the aedeagus. Penis divided in two parts; its basal valves robust, dorsally bearing widened lobes and ventrally, at anterior end, a pair of broad sclerotised plates. Apical valves of penis comparatively weak, their apices completely enclosed between valves of cingulum. Ejaculatory duct gradually widening from distal end to ejaculatory sac, part of which is enclosed between the sclerotised plates and main body of basal valves of penis; its distal continuation weakly sclerotised and continuous with spermatophore sac, which occupies a position dorsally to penis, and with the wide phallotreme, which has a moderately long slit-like opening.

Epiphallus, which occupies a middle position, large and shield-like, with a pair of complicated ventro-lateral appendices, which may be homologous with the oval sclerites in other families. Ancorae and lophi absent; lateral plates indistinct, but anterior projections (or analogous structures) large, with two rows of symmetrically arranged teeth and spines; posterior projections absent.

Family PAMPHAGIDAE (Pls. 16-18).

The phallic complex in the Pamphagidae has several peculiar features, which separate it sharply from that of the other families.

The classification of the family Pamphagidae was revised by Uvarov (1943), who divided it into nine tribes on the basis of external characters, but the phallic

complex varies only in secondary characters, and on this basis it is not possible to recognise any groups. Among the 32 genera studied only *Acinipe hesperica* Ramb. (Pl. 18, fig. 12) deviates in the shape of the epiphallus, and such deviation is not considered significant.

Some of the genera included in the Pamphagidae, although Pamphagid-like in general appearance, proved to be very different in their phallic complex. The external characters of these genera and species were studied in detail and this confirmed the conclusion that they do not belong to this family. The following genera and species are therefore removed from the Pamphagidae to other families :

Phrynotettix tchivavensis (Haldeman, 1852) and *Dracotettix monstrosus* Bruner, 1889, to the subfamily Romaleinae of Acrididae ;

Buforania crassa Sjöstedt, 1920 and *Phaneroцерus testudo* Saussure, 1888, to the subfamily Catantopinae of Acrididae ;

Batrachidacris rubridens (Uvarov, 1929), *Crypsicerus cubicus* Saussure, 1888 and *Crypsiceracris glabra* Miller, 1932, to Lathiceridae ;

Aucacris eumera Hebard, 1929 and *Anamesacris abajoi* Morales, 1949, are of doubtful position, but certainly not Pamphagidae (see p. 254).

Pamphagus elephas (Linné, 1758) (Pl. 16).

Ectophallic membrane thin, and not forming a capsule-like covering. Cingulum robust and strongly sclerotised, its apodemes connected by the zygoma ; seen from above, they are of horse-shoe shape. Rami fused with ectophallic membrane, weakly sclerotised, and covering apical valves of penis, except for extremities. Ventrally, rami separated from each other by a long and narrow sagittal slit, the margins of which are turned inwards and continuous with walls of phallotreme, forming cleft. Zygoma and apodemes occupying a middle position in relation to whole phallic organ. Arch of cingulum absent and zygoma connected directly with apical valves of penis. Endophallus represented by robust valves of penis and by endophallic sac. Valves of penis are completely divided into basal and apical ; basal valves straight with rounded anterior end and broadened and curved posterior end, where they are articulated with apical valves. Proximal parts of apical valves connected by zygoma, their apices upcurved and pointed. Ejaculatory duct strongly widened distally, forming on ventral side of penis a short ejaculatory sac. Spermatophore sac occupying a position between, and somewhat dorsally to, apical valves of penis ; not differentiated from the long and broad phallotreme, which forms a direct continuation of sac. Phallotreme with a very long slit-like ventral opening reaching distal end of ejaculatory sac, its margins turned outwards and continuing with rami and ectophallic membrane, forming cleft. (The ejaculatory sac and phallotreme were regarded by Radclyffe-Roberts (1941) as a single open ejaculatory sac, but the position of the sacs makes it clear that the apical extension with the ventral slit-like opening, which is located in the region of the apical valves of the penis, should be regarded as the phallotreme.)

Epiphallus a large, moderately sclerotised, shield-like structure, covering most of distal half of phallic organ. Ancorae small and finger-shaped ; lophi completely absent ; lateral plates indistinct or absent ; anterior projections, if present, more or less distinct ; and posterior projections absent or indistinct. Two symmetrical rows, or groups, of strong spines or small ridges on dorsal surface ; they probably perform the grasping function, replacing the absent lophi. Oval sclerites absent.

The principal features of the phallic complex were found to be the same in the 32 genera studied and variations are mostly in the shape and relative size of the apodemes and of the apical and basal valves of the penis, and also in the

degree of sclerotisation of the cingulum. The epiphallus is so uniform (Pls. 17, 18) that it may be regarded as a good taxonomic character of the family.

Family PYRGOMORPHIDAE (Pls. 19-21).

In the last revision of the Pyrgomorphidae (I. Bolivar, 1909) the family was divided on external characters into 14 tribes (including the Systellae and Xyronoti, which are now regarded as independent families). The present study of the phallic complex, however, does not suggest such a division, or any other grouping, within the family.

Phymateus morbillosus (Linné, 1758) (Pl. 19).

Cingulum capsule-like, sclerotised, almost completely covering endophallus. Distal part of capsule only weakly sclerotised, being merely a continuation of ectophallic membrane; proximal part strongly sclerotised and thickened, bearing dorsally and ventrally processes. (Whether any parts of this cingulum are homologous with the parts of the cingulum of other families is not clear.) Whole ectophallus united with endophallus only by membrane. Parts of cingulum may provisionally be called the zygoma, apodemes and rami. Ventral distal part of ectophallus, or ramus, split sagittally, its margins turning inwards, and continuous internally with walls of phallotreme, forming short cleft. Dorsal distal part also divided, forming a pair of lobes with slightly sclerotised internal margins and a pair of strongly sclerotised short processes, regarded as valves of cingulum. Endophallus represented by a pair of undivided valves of penis, joined only by membrane of endophallic sac. Distal parts of valves, provisionally called apical valves of penis, upcurved, with acute apices; median parts of valves strongly thickened above, robust, and excised internally; proximal parts of penis, provisionally called basal valves, are robust and widened laterally, with rounded ends. Ejaculatory duct reaching to about middle of valves of penis, where it begins to widen; at beginning of widening, a pair of valves, which apparently close or open distal end of duct. Further distal continuation of duct is strongly widened and forming ejaculatory sac with soft walls, occupying ventral position, and being large and strongly widened towards distal end. Above penis, ejaculatory sac continuing as the large, hemispherical hard-walled spermatophore sac, which lies more proximally and is connected with ejaculatory sac by a narrow slit between valves of penis, the gonopore. Both sacs continuous with the broad phallotreme, which is open distally and has a moderately long, slit-like ventral opening, reaching distal end of ejaculatory sac; margins of opening turned outwards and continuous with membrane of ectophallus, forming the cleft.

Epiphallus lying on proximal part of phallic organ, bridge-shaped, robust, and strongly sclerotised; ancorae completely absent; lateral plates with strong posterior projections, forming strongly upcurved hooks (probably analogous in function with the lophi); anterior projections indistinct. Most characteristic feature is presence of dorso-lateral appendices, united basally with main body of epiphallus.

The secondary characters of the phallic complex vary between genera and species. The epiphallus is rather uniform (Pls. 20, 21); it was found to present some deviations in only three of the 37 genera studied: *Atractomorpha* (Pl. 21, fig. 16) has a peculiarly shaped disc, with strongly developed posterior part; *Omura* (Pl. 21, fig. 17) has the dorso-lateral appendices displaced to a position inside the lateral plates; and *Betisca* (Pl. 21, fig. 15) has spines on the middle of the bridge.

The phallic complex of the family Pyrgomorphidae does not allow it to be regarded as closely related to any other family. On the basis of external

characters (the structure of the hind femur, and the presence of the fastigial furrow) it has been placed nearest to the Pamphagidae, but the differences in the phallic complex of the two families are extremely striking. Their common external characters are found also in some genera of Catantopinae. Thus, the fastigial furrow is developed in *Gemeneta*, *Sitalces*, *Ommatolampis*, *Rachicreagra*, *Psiloscirtus*, and some others; the peculiar structure of the hind femur, with the lower basal lobe longer than the upper one, is found in *Philippiacris* and in some genera of Romaleinae. Since these external characters are not restricted to the Pamphagoid group of families and the family Pyrgomorphidae, they lose much of their value as compared with the phallic characters.

The Pyrgomorphidae have a common character with the Ommexechidae in the undivided valves of the penis, but differ strongly in other characters of the phallic complex. In their external characters, Ommexechidae are, however, close to the Pyrgomorphidae, as they have a fastigial furrow (sometimes indistinct); the structure of the hind femur is transitional, the lower basal lobe being of the same length as the upper one.

Family LENTULIDAE fam. n. (Pls. 22-25).

Fifteen genera (see Pl. 25), hitherto placed in Catantopinae, exhibit in their phallic complex such great differences from other members of the subfamily that they should be regarded as a group of family rank.

The main features of the phallic complex of this new family are as follows:

Ectophallic membrane soft; cingulum well differentiated, with apodemes, zygonia and rami present; rami and their continuation (the sheath) strongly sclerotised, forming a capsule-like covering for apical part of endophallus, fully enclosing apical valves of penis; arch of cingulum absent; valves of penis undivided; gonopore processes absent; ejaculatory sac large or of moderate size, located below penis; spermatophore sac large, located above penis; phallosome long or short, forming a long or short cleft. Epiphallus bridge-shaped, with ancorae and lophi (Pl. 25); oval sclerites present.

The main external features of the new family are:

Body small or medium size, varying from rather short and robust to elongate, stick-like; integument from smooth and shining to coarse and strongly rugulose. Head varying in shape—prognathous, oedipodioid, or pyrgomorphoid; antennae short, with 16-26 segments; fastigial furrow absent. Pronotum short, cylindrical or tectiform, with median and lateral carinae weak or absent. Prosternal tubercle present. Wings completely absent. Tympanum absent. Abdominal spiracles located on the lower, incurved edges of tergites, except the first, which is on the membranous edge of the tergite, and the last which is at the distal corner of the eighth tergite. Hind femur with upper basal lobe longer than lower one. External apical spine of hind tibia present or absent. Male subgenital plate laterally compressed.

The phallic complex of Lentulidae differs greatly from that in the other families; it has, however, some characters in common with Pyrgomorphidae, such as the undivided valves of the penis and the similar dorsal position of the spermatophore sac, but the differentiated cingulum and epiphallus and the external characters suggest only remote relationship between the two families.

The external features of the new family suggest a retrogression (e.g. the

absence of wings and tympanum) and do not provide good diagnostic characters. It must be emphasised, however, that the complete absence of wings and tympanum is constant and normal in this family, while in the other families of the Acridid complex it occurs only as a deviation.

Since the new family has a rather wide range of variability in the secondary characters of the phallic organ, three genera are described and figured (*Lentula obtusifrons* St., Pl. 22; *Eremidium equuleus* Karsch, Pl. 23; and *Gymnidium turbinatum* Karsch, Pl. 24); they are also very different in external characters.

The Lentulidae occur mostly in southern, south-western and eastern Africa, reaching Kenya in the north. The small size of the family, its restricted distribution area, and the rather divergent morphological characters of the genera, suggest that it may represent a relic of an ancient fauna.

It is with great hesitation that the genus *Rhcnoderma* from Costa Rica (C. America), is temporarily attached to this family. The valves of the penis in this genus are undivided; the cingulum is similar to that of Lentulidae; the epiphallus (Pls. 25, 15) is simplified as in that family, but the spermatophore sac, though very large as in the genus *Lentula*, lies below the valves of penis. In its external characters *Rhcnoderma* approaches *Lentula*. The position of the spermatophore sac and the geographical distribution, however, make the affinities of these two genera very uncertain.

Lentula obtusifrons Stål, 1878 (Pl. 22).

Ectophallic membrane fused in its apical half with cingulum; apodemes of cingulum weakly sclerotised, narrow, located proximally to epiphallus; zygoma represented by a weakly sclerotised longitudinal ribbon-like sclerite, fused with ectophallic membrane; rami strongly sclerotised and continuous with sheath, which completely covers apical valves of penis; zygoma, rami and sheath forming a capsule-like covering to apical half of endophallus; sheath with a distal and ventral slit-like opening continuous below with walls of phallotreme and forming a short cleft. (The whole sheath functionally corresponds to the aedeagus.)

Endophallus consisting of a pair of narrow, undivided valves of penis, apically narrowed, upcurved and acute, which may provisionally be regarded as apical valves of penis; their basal ends, with a small lobiform expansion, may be regarded as basal valves of penis. Ejaculatory sac comparatively large, situated below and partly between valves of penis; spermatophore sac very large, almost as long as whole penis, situated above penis and with sclerotised dorsal wall; inside sac, a pair of membranous longitudinal plate-like structures attached to valves of penis (Pl. 22, fig. G), which may separate spermatophore sac from ejaculatory sac. (Functionally these structures may be analogous to the gonopore processes and, by lateral movement, they probably close or open the gonopore slit between the sacs and regulate the flow of sperm.) Phallotreme short, with a ventral slit-like opening, which, with ectophallus, forms a short cleft.

Epiphallus placed in proximal part of phallic organ, strong, bridge-shaped; ancorae well developed; lophi tooth-shaped, with obtuse apex; lateral plates small; anterior and posterior projections indistinct. Oval sclerites present.

Eremidium equuleus Karsch, 1896 (Pl. 23).

Ectophallic membrane thin, forming a rather deep, basal fold, bilobate at apex. Cingulum well differentiated, strongly sclerotised. Apodemes long and narrow; zygoma broad and long, less sclerotised than other parts of cingulum. Rami large, fused below, continuous distally with the sheath which completely covers apical valves of penis; below, rami forming a short cleft, continuous with walls of slit-like ventral opening of phallotreme. Zygoma,

rami and sheath together form a capsule-like structure, which covers apical third of endophallus and functionally corresponds to aedeagus. Arch of cingulum absent.

Endophallus represented by a pair of undivided valves of penis, basal parts of which may be regarded as basal valves and apical parts as apical valves; basal valves large, plate-like and strongly expanded; apical valves short, broad, tapering towards apex. Ejaculatory sac placed below penis. Spermatophore sac located above penis and continuous with the broad phallotreme, which below forms a slit-like opening beside which the phallotreme has a large distal opening, the edges of which are joined with sheath.

Epiphallus lies in proximal part of phallic organ, bridge-shaped, strongly sclerotised; ancorae large; lophi long, tooth-shaped, and liable to be confused with lateral plates, which are small and difficult to distinguish from the lophi; anterior and posterior projections indistinct. Oval sclerites present.

Gymnidium turbinatum Karsch, 1896 (Pl. 24).

Ectophallic membrane forming a short basal fold. Cingulum well differentiated and strongly sclerotised. Apodemes narrow, comparatively weak; zygoma long and broad; rami strongly sclerotised, fused below and continuous with sheath, which completely covers apical valves of penis; internal walls of rami with a pair of large, strongly sclerotised projections (Pl. 24, fig. D), which may partly be seen from above if zygoma and apodemes are removed. Zygoma, rami and sheath forming a capsule-like structure covering whole apical half of endophallus.

Endophallus consisting of a pair of undivided valves of penis, basal part of which may be regarded as basal valves and apical part as apical valves. Basal valves wide and plate-like, with a pair of large dorsal projections, between which the spermatophore sac is situated. Apical valves long and rather thin, narrowing apically and pointed. Ejaculatory sac situated below, partly between valves of penis, small at base, but with a large ventral continuation, with very thin walls, which is probably a supplementary structure for storage and possibly for regulation of the flow of sperm. Spermatophore sac situated above the valves of penis; its distal part continuous with the long and broad phallotreme, which is broadly open distally and also has a slit-like opening above and below; together with edges of rami, it forms a short cleft.

Epiphallus on dorsal proximal half of phallus, bridge-shaped; ancorae large, fused with anterior projections of lateral plates; lophi large, tooth-shaped; lateral plates small; anterior and posterior projections weak. Oval sclerites present.

Family LATHICERIDAE (Pls. 26; 27, figs. 4, 5).

This family includes four genera: *Lathicerus* Saussure, 1888, *Crypsicerus* Saussure, 1888, *Batrachidacris* Uvarov, 1939 and *Crypsiceracris* Miller, 1932, which were regarded by Saussure (1888) and by Uvarov (1929) as members of the subfamily Oedipodinae. In 1943, Uvarov transferred them to Pamphaginae and temporarily to the tribe Trinchini. In 1954, a new subfamily Lathicerinae was erected (Dirsh, 1954), and its rank is now raised to family. The family is characterised by certain external characters not found in other families (see Dirsh, 1954) and by the peculiar phallic complex, which is also very different from that of other families.

Owing to the great rarity of these insects, the phallic complex of only two genera and species was studied: *Lathicerus cimex* Saussure, 1888 (Pl. 27, fig. 5) and *Batrachidacris rubridens* (Uvarov, 1929) (Pl. 26 and Pl. 27, fig. 4). Although different in details they are similar in the principal characters.

Batrachidacris rubridens (Uvarov, 1929) (Pl. 26, Pl. 27, fig. 4).

Ectophallic membrane covering most of phallic organ loosely, and forming a very large and deep basal fold; it has irregular lateral sclerotised bands, which probably have a supporting function. Cingulum sclerotised, plate-like, not differentiated into apodemes and zygoma, and occupying an unusual position on proximal dorsal end of phallus; distal end with a pair of triangular projections. Rami, which join plate of cingulum dorso-laterally and laterally, are weakly sclerotised and located distally to plate; they are not connected ventrally and form a very short cleft connected with ventral slit of phallotreme. Arch of cingulum absent. Basal valves of penis are a pair of large, broad sclerites separated from apical valves, their distal ends lying between the latter. Apical valves of penis are of irregular shape, rather broad, strongly sclerotised, but with internal and apical edges membranous. Endophallic sac poorly differentiated into ejaculatory and spermatophore sacs; the former rather small, situated ventrally to penis; the latter also small, situated above and partly between valves of penis. Phallotreme short, with a distal and short slit-like ventral opening which forms, with ventral edges of rami, a very short cleft.

Epiphallus (Pl. 27, fig. 4) short and broad, bridge-shaped or ribbon-like, located very proximally; ancorae absent; lophi strong and tooth-like; lateral plates small; anterior and posterior projections weak. Oval sclerites large, of peculiar triangular shape with curved edges, and situated very close to epiphallus.

The family Lathiceridae differ sharply from the others, and the few common characters are superficial. The divided penis occurs also in Pamphagidae, but the positions of its basal and apical valves and their connection are quite different. The undifferentiated cingulum is in common with Pyrgomorphidae, but it is plate-like, not capsule-like as in the last family. The characters in common with Acrididae are the bridge-shaped epiphallus and the presence of the oval sclerites, but their shape and position are different; in the last two characters there is some resemblance to Ommexechidae, which also possess short but broad epiphallic bridges and closely located oval sclerites.

Family OMMEXECHIDAE (Pls. 28; 27, figs. 6-10).

This family consists of a few genera found only in South America. The phallic complex in all of them is very uniform and clearly separates the Ommexechidae from the other families. A particularly good character is the epiphallus, which may be used as a single family character (Pl. 27, figs. 6-10).

The relations of this family with others are obscure; the only one with which it has some characters in common is the Pyrgomorphidae (see p. 243).

Ommexecha servillei Blanchard, 1836 (Pl. 28).

Ectophallic membrane soft; basal fold short; ventral lobe present. Cingulum well differentiated, but weak and thin. Apodemes small and weak; zygoma comparatively large and long. Rami very large, forming distally a large sheath completely covering apical valves of penis; in its apical half, dorsally and ventrally, it has a slit-like opening, and below participates in formation of cleft. Arch of cingulum absent.

Endophallus represented by a pair of valves of penis connected by the very long flexure, their basal valves wide, plate-like, with peculiar branches at distal end. Gonophore processes absent, but lower margins of basal valves probably perform their function. Apical valves of penis plate-like, expanded downwards, with serrated internal edges, and joined to basal valves of penis by a long, narrow flexure.

Ejaculatory sac large, with a pair of posteriorly protruding, lateral pockets, located

partly proximally and below valves of penis; walls of whole sac strongly rugulose. Spermatophore sac comparatively small, placed below valves of penis. Phallotreme long, rather broad, with a large distal opening and a slit-like opening on both ventral and dorsal sides respectively.

Epiphallus located on dorso-proximal part of phallus, bridge-shaped; its lateral plates separated from bridge and joined only by a membranous connection. Ancorae absent; lophi large, tooth-shaped; anterior and posterior projections small. Oval sclerites present, situated very close to epiphallus.

Family PAULINIIDAE (Pls. 29; 27, fig. 11).

This small family includes only two South American genera. It was previously regarded as a subfamily, but the phallic complex suggests it should be regarded as of family rank. Only the genus *Paulinia* was studied.

Paulinia acuminata De Geer, 1773 (Pl. 29).

Ectophallic membrane thin, but bearing a pair of ventro-lateral sclerotised plates. Cingulum well differentiated, but comparatively weakly sclerotised. Apodemes long and thin; zygoma small. Rami of cingulum small, their distal continuation membranous. Arch of cingulum very large and strong, with a large dorsal branch connected with ventral side of zygoma; ventrally, arch bears a pair of strong valves, slightly longer than apical valves of penis and closely attached to them; whole arch joined to base of apical valves of penis.

Endophallus represented by a pair of fully divided valves of penis. Basal valves large, with strongly expanded plates and a pair of additional sclerites (Pl. 28, figs. j, k) on dorsal side of proximal end. Gonopore processes large, plate-shaped. Apical valves of penis comparatively short, with weakly sclerotised apices. Ejaculatory sac large, located below penis, with a pair of lateral projections at base. Spermatophore sac small, placed between and partly above valves of penis. Phallotreme short, with a distal opening only.

Epiphallus median, bridge-shaped. Ancorae large; lophi large, finger-shaped. Lateral plates large, connected with bridge by membrane; anterior and posterior projections indistinct. Oval sclerites present, very close to epiphallus.

The family Pauliniidae is not closely related to any other family. The divided penis is a feature which probably developed independently, and does not suggest relationship with the Pamphagoid group of families. The bridge-shaped epiphallus is similar to that of Acrididae, but the mode of attachment of lateral plates to the bridge and the complicated structure of the ejaculatory sac resemble those of Ommexechidae.

Family ACRIDIDAE.

The family Acrididae is the largest one in the Acridoidea. In this work it is treated as consisting of four old subfamilies, Acridinae (with Oedipodinae as a group), Egnatiinae, Catantopinae and Romaleinae; one restored, the Calliptaminae; and four (the Euryphyminae, Hemiacridinae, Eremogryllinae and Truxalinae) are raised to a higher taxonomic level, having been previously regarded as groups.

The phallic complex in this family shows a greater range of variation than in the families described above. Nevertheless, both the phallic complex and the external characters make it possible to unite the subfamilies mentioned above into one family.

The main characters of the phallic complex of this family are as follows :

Ectophallic membrane always soft and not forming a capsule-like structure ; ventral lobe present or absent ; ventral infold present or indistinct. Cingulum well differentiated and usually strongly sclerotised. Apodemes and zygotoma well developed ; rami sclerotised or membranous, their distal continuation sometimes forming a membranous sheath round apical valves of penis. Arch of cingulum present or absent. Apical and basal valves of penis connected by a flexure, which varies between fairly robust (in Romaleinae) to very thin, with a tendency to disappear (in some species of Catantopinae with a very elongate and thin body), and completely or almost completely disappearing (in Hemiacridinae). Gonopore processes present. Ejaculatory sac small, placed below penis. Spermatophore sac usually in median position. Phallotreme short, with or without a ventral slit-like opening.

Epiphallus bridge-shaped, located on dorso-proximal part of phallus ; ancorae and lophi present ; lateral plates usually present (but sometimes all parts very reduced and occasionally absent so that only disc of epiphallus remains, e.g. in group Pargae). Oval sclerites present and rather distant from epiphallus.

The main differences between the phallic complex of the Acrididae and that of the other families are the presence of a flexure connecting the basal and apical valves of the penis, the frequent median position of the spermatophore sac, the bridge-shaped epiphallus and the remote position of the oval sclerites.

Subfamily ROMALEINAE (Pls. 30, 31).

This subfamily was recently erected by Radclyffe-Roberts (1941) on the basis of the phallic complex. The present study of 28 genera of it has shown that the phallic complex differs from that of the subfamily Catantopinae only in secondary features, which are not in themselves sufficient to separate the two. However, the Romaleinae possess an excellent external diagnostic character, not mentioned by Radclyffe-Roberts. This is a stridulatory organ on the hind wings, the structure of which is as follows : the first vannal area (terminology of venation according to Snodgrass, 1935) of the wing is narrow and its membrane is convex ; when the wing is flexed, it forms a tube-like fold (vannal fold) on the dorsal edge of the wing. The whole of this area is covered with arched, parallel, transverse veinlets, which are finely but strongly serrated. The stridulation is probably affected by rubbing the lower surface of the elytra, the veins of which are strongly convex on the underside, against the serrate veinlets. The cubital, and second vannal areas of the wing, and usually the medial area also, are expanded, and each also has a row of regular, parallel, thickened, transverse veinlets. These areas probably serve as resonators. This specialisation, as well as the serrate veinlets, can be observed even in the rudimentary wings of *Phrynotettix*, *Dracotettix*, *Brachystola*, *Kabulia* and *Acrostegastes*.

The phallic complex of the Romaleinae is as variable as that of some other groups of Catantopinae, and their epiphallus is very similar to that of the group Cyrtacanthacres of the Catantopinae.

This subfamily has been known only from America, where it is represented by a number of genera of divergent external appearance. Three Asiatic genera, *Teratodes*, *Pelecnotus* and *Kabulia*, and the African *Acrostegastes*, have a venation of the hind wings typical of the subfamily Romaleinae, from which they do not differ in the phallic complex ; they are therefore here transferred to it. The external apical spine of the hind tibia, which is present in the American

Romaleinae, is absent in the Old World genera; the value of this character, however, has been overrated in the past, and it cannot be regarded as a valid objection to placing the above-mentioned genera in this subfamily. It is difficult to decide whether the Old World genera with very rudimentary wings, such as *Robecchia* and *Lyrotylus*, also belong to it, but in view of their apparent relationship to *Teratodes*, this appears to be a reasonable arrangement. The occurrence of Romaleinae in these two widely separated areas is not, of course, without parallel in other groups of animals and plants.

Romalea microptera (Beauvais, 1805) (Pl. 30).

Ectophallic membrane with a pair of lateral, partly sclerotised tubercles (lateral lobes, Radclyffe-Roberts, 1941), and ventrally, at its distal end, with a short ventral fold, partly covering proximal ventral part of rami. Ventral infold large. Cingulum well differentiated, apodemes and zygoma thick, strongly sclerotised. Rami of cingulum weakly sclerotised partly fused with ectophallic membrane and, below, forming part of cleft. Arch of cingulum absent. Endophallus rather robust. Basal valves of penis large and thick, with short, strong gonopore processes, and connected with apical valves by a thick flexure. Apical valves small, thin, slightly upcurved with articulated dorsal appendices. Ejaculatory sac large, located below penis. Spermatophore sac large, situated mostly between, but also partly below and partly above, valves of penis. Phallotreme short, with a distal and a short ventral slit-like opening, edges of the latter connected with distal excision of ventral side of rami, forming a short cleft.

Epiphallus situated on dorso-proximal end of phallus, robust, bridge-shaped. Ancorae small, finger-shaped; lophi very large, robust, tooth-shaped; lateral plates comparatively small; anterior projections distinct, posterior ones small. Oval sclerites present.

Subfamily CATANTOPINAE (Pls. 32-44).

After removal from the old subfamily Catantopinae of the family Lentulidae and the subfamilies Hemiaceridinae, Calliptaminae and Euryphyminae, the restricted subfamily Catantopinae still remains very heterogeneous and may have to be subdivided in future.

Although the external characters and the general appearance of the members of this subfamily are extremely divergent, the phallic organ is fairly uniform in its principal characters.

The phallic complex of *Catantops melanostictus* Schaum is described and figured as typical for the whole subfamily (Pl. 32). Altogether 321 genera were studied, and their epiphalli are figured (Pls. 33-44). The epiphallus is very variable and in some cases may be used for separating tribes and groups of genera. In all cases, it is bridge-shaped and has ancorae and lophi, but the bridge is often distinctly divided into two halves connected only by thin membrane; there are, however, transitional forms, in which it is difficult to decide whether there is a real division or merely a thinning of the bridge.

Catantops melanostictus Schaum, 1854 (Pl. 32).

Ectophallic membrane thin, forming short basal fold, a slightly sclerotised ventral fold and a ventral lobe with a strongly sclerotised transverse bar; this lobe has a membranous connection with proximal end of ventral parts of rami, thus forming the ventral fold; in its normal position, lobe covers ventro-proximal part of rami and part of cleft. Cingulum strongly sclerotised, consisting of a pair of strong apodemes, zygoma and strongly sclerotised

rami. Zygoma connected with the strong arch of cingulum, from which project a pair of cingular valves occupying a position between, and partly above, apical valves of penis. Penis strongly sclerotised; its valves divided into basal and apical parts, connected by a flexure. On ventral side of basal valves, a pair of large, strong gonopore processes. Ejaculatory sac small, situated below penis. Spermatophore sac mainly below penis and partly between its valves. Phallotreme short, with opening between apical valves of penis and with another opening, slit-like, below, where its edges are continuous with ventral edges of rami of cingulum, forming cleft.

Epiphallus situated on dorso-proximal part of phallus, bridge-shaped. Ancorae large, finger-shaped; lophi tooth-shaped; lateral plates large, with distinct anterior and large posterior projections. Oval sclerites present.

Numerous tribes and groups of genera have been recognised within this subfamily, but only some of them are based on reasonably good characters. Diagnoses of tribes and groups have often not been given, and in many cases their scope has since been altered. This has created such confusion that a new revision of the whole subfamily, based on all external and internal characters, is needed. In this present work, no tribes are recognised, only the taxonomically indefinite unit "group" is used and only a few of the groups are mentioned below. Groups of uncertain value, or consisting of two or three genera only, are temporarily placed in a large group of genera of indefinite position (p. 254).

Group *Cyrtacanthacres* (Pl. 33).

The phallic complex in this group has no special features. Variation in the secondary characters occurs mainly in the shape of the apical (and, to a lesser extent, basal) valves of the penis, and in the epiphallus, which is very strong, with a comparatively narrow bridge. Ancorae small, sometimes rather indistinct. Lateral plates large, with anterior, mostly indistinct projections and small posterior ones. Lophi lobe- or tooth-shaped, sometimes so large that they may be confused with the lateral plates. On the whole, the epiphallus in this group is very near to that in the group *Catantopes* and very similar to that in the *Romaleinae*.

This group consists of a number of genera of mostly very large insects which differ from the other groups of *Catantopinae* only by the rectangular shape of the mesosternal lobes.

Group *Catantopes* (Pl. 34).

The group *Catantopes* is very near to the *Cyrtacanthacres*, from which it differs by the rounded mesosternal lobes. The epiphallus is quite similar in both groups, except that in the *Catantopes* the ancorae are in most cases relatively larger.

Group *Podismae* (Pls. 35, 36).

The phallic complex and the external characters of this group are indefinite and it can be recognized only by general appearance.

Group *Dericorythi* (Pl. 37, fig. 1).

Epiphallus bridge-shaped; ancorae rather large; lophi lobiform; lateral plates rather large; anterior and posterior projections distinct.

This group is characterised by the median carina of the pronotum usually

being strongly raised in the prozona and forming a crest, and by the curved hind tibia, which has an external apical spine.

Group Apobolei (Pl. 37, figs. 2, 3).

Phallic organ and epiphallus usual for the subfamily, though slightly simplified. Bridge rather narrow; ancorae short; lophi simple, lobiform; lateral plates large; anterior and posterior projections rather small.

The genera of this group possess an excellent diagnostic character in the costal area of the elytron, which is expanded and bears a dense series of thickened, parallel, oblique veinlets, probably serving for stridulation.

Group Serpusiae (Pl. 37, figs. 4-7).

Epiphallus similar to that in the Apobolei, the bridge being rather long and narrow. Ancorae short, finger-shaped; lophi lobiform, broad and short; lateral plates relatively large; anterior and posterior projections distinct.

Group Conophymae (Pl. 37, figs. 8-14).

Epiphallus somewhat simplified: bridge rather narrow; ancorae small, finger-shaped; lophi mostly hook-shaped; lateral plates small; anterior and posterior projections distinct.

This group was recently erected as a tribe by Mistchenko (1952) on the external appearance. He excluded from it the genus *Sphenophyma* Uvarov, 1934, but in the structure of its epiphallus (Pl. 37, fig. 14) and in external characters this genus is very near to *Conophyma* and should be included in the Conophymae. On the other hand, *Conophymacris* Willemse, 1933, which Mistshenko (*l.c.*) placed in the Conophymae, should be excluded from it, not only because of the epiphallus (Pl. 41, fig. 13), but also on the shape of the pronotum and elytra. It is here relegated to the group of genera of uncertain position.

The genera *Arminda* Krauss, 1892, and *Dinaria* Popov, 1951, are tentatively referred to this group.

Group Oxyrrhepes (Pl. 37, figs. 15-19).

Phallic organ of the usual Catantopoid type, but with some deviations, e.g. the tendency of the flexure to disappear so that the apical and basal valves of the penis are almost separated. Cleft rather long and ventral lobe may or may not be developed. Epiphallus rather variable.

The main external diagnostic characters of the group are: the very elongate body, the closed mesosternal interspace, and the peculiar, apically broadened or compressed, prosternal tubercle (except in *Chloroxyrrhepes*).

By the tendency to lose the flexure between the basal and apical valves of the penis, the group approaches the subfamily Hemiacridinae, but the stridulatory veinlets on the elytra, characteristic of the latter, are absent.

Group Tropidopolae (Pl. 37, figs. 20-24).

Phallic organ of the usual type, but basal and apical valves of the penis have a tendency

to lose the flexure, as in the group *Oxyrrhpes*. Epiphallus variable and sometimes divided into two halves or has a tendency to be so.

Externally, this group is characterised by the strongly elongated, narrow body and the elongated fastigium of the vertex.

Group *Oxyae* (Pl. 38).

Epiphallus divided along the middle into two halves connected only by thin membrane; this division is sometimes not very clear, but is always noticeable. Ancorae mostly small, sometimes absent, rarely large; lophi hook-, tooth-, or lobe-shaped; lateral plates small; anterior projection sometimes indistinct, posterior one distinct.

This type of epiphallus may occur in other groups and in many of the genera of indefinite position, but members of the group *Oxyae* also possess a good external character, namely, the very acute, spine-like lower external lobe of the hind knee. The expanded edges of the hind tibia provide another character, but this is an adaptation for swimming which also occurs in other entirely unrelated genera with semi-aquatic habits.

Group *Leptismae* (Pl. 39, figs. 1-11).

In many respects this group, consisting only of American genera, is nearest to the Old World group *Oxyae*, but there are certain characters which separate them.

Epiphallus rather variable; in many cases it is divided as in *Oxyae*, sometimes incompletely or even not at all, but the tendency towards a division always exists, the median part of the bridge being less sclerotised than the rest. Ancorae small and sometimes indistinct; lophi finger-shaped, lobiform or sometimes fused together into one median projection; lateral plates relatively large, anterior and posterior projections distinct; bridge usually moderately broad, sometimes very broad, but sometimes narrow.

The external characters of the *Leptismae*, however, are rather different from those of *Oxyae*. They have no external apical spine on the hind tibia, this being present in the *Oxyae*; the male cercus is upcurved, while in *Oxyae*, it is not; the apex of the lower lobe of the hind knee is obtus- or acutangulate but not pointed (only in *Tetrataenia* the apex is pointed but not spine-like as in the *Oxyae*); the hind tibia is expanded as in the *Oxyae*. The general appearance, including even the pattern of colouration, is, in some cases, strikingly *Oxya*-like.

Group *Coptacrae* (Pl. 39, figs. 12-25).

Epiphallus divided; the division usually very sharp, but sometimes incomplete or somewhat indistinct. Ancorae mainly large and incurved; lophi large, hook-shaped or lobiform, sometimes rather complicated in shape; lateral plates well-developed; anterior projections present, but sometimes indistinct; posterior projections small, distinct.

The external characters of the group are not very distinctive, but, with some exceptions, are reliable: Male supra-anal plate triangular, but with apex attenuated (in *Apalacris* and *Opharicus*, plate simple); last tergite with a furcula (indistinct in *Apalacris*); cerci usually incurved or decurved; pronotum in most cases slightly tectiform, without lateral carinae; elytra often obliquely truncate at apex.

Group Eyprepocnemes (Pl. 40).

This group was once regarded as a subfamily (Jacobson and Bianchi, 1902), but later authors included it in the subfamily Catantopinae as a tribe, or even did not recognise it as a distinct group.

Phallic organ of the usual type, with some variation. Epiphallus bridge-shaped, mostly weakly sclerotised, sometimes with whole disc thin and membranous; ancorae weakly sclerotised, large, most strongly curved, and articulated with disc; lophi large, lobiform, weakly or moderately sclerotised, lateral plates distinct; anterior projections well developed and sometimes forming processes; posterior projections small.

The external characters of the group are:

Apex of male cercus lobiform, rounded or acute, and more or less compressed and curved downwards. Lateral carinae of pronotum mostly distinct, but not sharply so. Hind femur mostly long and narrow. Interocular space broad.

Ungrouped genera of Catantopinae (Pls. 41; 42; 43; 44, figs. 1-23).

Many genera cannot be placed with certainty into any of the above groups of Catantopinae; nor can they satisfactorily be grouped among themselves. Some previously established tribes and groups, distinguished on insufficient external characters, or represented by only one or two genera, are also included here.

Genera of uncertain position (Pl. 44, figs. 24-30).

The following seven genera placed previously in the Catantopinae, are very aberrant in the structure of the phallic complex or in external characters, or in both respects. Some of them probably do not belong to this subfamily, but lack of material makes definite conclusions impossible. *Anamesacris* Uvarov, 1934; *Aucacris* Hebard, 1929; *Bactrophora* Westwood, 1842; *Bufonacris* Walker, 1871; *Hepalicus* Sjöstedt, 1921; *Lithoscirtus* Bruner, 1907; *Philippiacris* Libermann, 1943.

Subfamily CALLIPTAMINAE (Pl. 45).

The phallic organ in this subfamily is of the usual Catantopoid type, but the epiphallus differs strongly from that in all other subfamilies.

Epiphallus plate-like, mostly trapezoidal, narrowing anteriorly. Ancorae short and strong, finger-shaped, with their bases in middle of disc or of its anterior half. Lophi completely absent; lateral plates distinct; anterior projections usually present, sometimes indistinct; posterior projections well developed. In middle of disc, at base of ancorae, there is sometimes a pair of holes covered by thin membrane. The shape of the epiphallus may serve as the single diagnostic character of the subfamily.

The following external features may be mentioned in addition: male cercus very strong and large, incurved, adapted for grasping the end of the female abdomen; its apex lobiform, rounded and armed with one or two subapical hooks. Pronotum with distinct (seldom obliterated) lateral carinae; head robust; frons vertical (except in *Botrocaracris*); interocular space broad.

The epiphallus of the Calliptaminae was probably derived from the usual bridge-shaped form, since in some genera there is a tendency towards the formation of a bridge; loss of the lophi and the general simplification may be secondary.

Subfamily EURYPHYMINAE **subfam. n.** (Pl. 46).

This subfamily includes genera with a strikingly distinct type of epiphallus, although the phallic organ is of the common Catantopoid type.

Epiphallus bridge-shaped, divided longitudinally in the narrowest part of the bridge into two halves connected only by thin membrane; it is very strong and robust. Ancorae comparatively small, of irregular shape; lophi very large, larger than lateral plates, hook- or valve-shaped, acute or rounded at apex; lateral plates small; anterior projections indistinct, posterior ones mostly well developed. Surface of posterior part of body of epiphallus strongly recurved in front, forming an acute angle with posterior part. Oval sclerites very small.

The external characters of the subfamily include a very peculiar form of the male cercus, which is robust, strongly expanded at the base and mostly with upcurved apical part. Posterior margin of last tergite thickened and strongly sclerotised. Supra-anal plate with strongly sclerotised tubercles. Head robust; frons vertical; interocular space broad. Lateral carinae of pronotum mostly distinct.

In general appearance the Euryphyminae are very similar to the Calliptaminae, but differ in the epiphallus and male cercus, which in the Calliptaminae serve for grasping the end of the female abdomen, but in Euryphyminae are used for depressing and holding the supra-anal plate of the male and possibly for depressing and holding down the subgenital plate of the female (Pl. 1, fig. 7).

Subfamily HEMIACRIDINAE **subfam. n.** (Pls. 47-50).

A rather large number of genera of the subfamily Catantopinae, in its former scope, possess certain peculiarities in the phallic complex which make it necessary to erect a new subfamily for them.

The main features of the phallic complex, which are characteristic for the new subfamily, are as follows:

Ectophallic membrane soft, with sclerotised plates in distal part of phallus. Cingulum well differentiated, strongly sclerotised, with mostly membranous rami. Arch of cingulum present. Valves of penis completely divided into basal and apical ones (in a few genera mentioned below, there is a tendency towards formation of a flexure-like connection); valves enclosed in sheath formed by rami, valves of cingulum or both. Gonopore processes small or absent. Ejaculatory sac small, of a simple spherical form. Spermatophore sac occupying a ventral, middle or sometimes partly dorsal position. Epiphallus bridge-shaped. Oval sclerites present.

Apart from the phallic characters, the Hemiacridinae have an excellent venational character, which separates this subfamily from others; namely, a series of regular, parallel, thickened, transverse veinlets between the radial and medial veins (radial area) of the elytra; these veinlets form part of a stridulatory organ of a type not found in other subfamilies. In species with rudimentary elytra, these veinlets may be indistinct; in such species, and in wingless ones, the structure of the phallic organ provides an alternative subfamily character.

There are a few uncertain genera in the subfamily. In *Hieroglyphus*, for example, the stridulatory veinlets in the radial area of the elytra are weakly developed and there is a tendency towards the formation of a weakly sclerotised, flexure-like connection between the basal and apical valves of the penis. In

Oraistes, the transverse veinlets are well developed (and not confined to the radial area) and there is also a tendency towards a flexure. Two American genera, *Aleuas* and *Zygoclistron*, possess very well-developed transverse veinlets, and, in both, the basal and apical valves of the penis are connected by a thin flexure; they have no apical external spine on the hind tibia, though these are present in most genera of the subfamily.

The new subfamily exhibits a wide range of variation in external appearance and in the secondary characters of the phallic complex.

The two extreme forms of the phallic complex in the subfamily (genera *Hemiacris* (Pl. 47) and *Tarbaleus* (Pl. 48)) are described and figured.

Hemiacris fervens Walker, 1870 (Pl. 47).

Ectophallic membrane with a pair of sclerotised plates (*Sc*₁) on sides of apical part. Cingulum well differentiated and strongly sclerotised. Apodemes long, their distal part produced far beyond zygoma, which is large and broad. Rami membranous, only partly sclerotised (*Sc*₂), joined below and forming part of a short cleft; at distal end forming a sheath covering valves of cingulum and, within them, apical valves of penis. Zygoma joined below with the strong and long arch of cingulum, from which a pair of long, narrow valves project; apices of these valves strongly expanded and enclosing apical valves of penis; functionally they may be regarded as apex of aedeagus. Valves of penis divided into basal and apical; basal valves joined together proximally and markedly widened distally; below, they form a pair of small gonopore processes. Apical valves of penis short simple, rod-like, with a pair of small lateral longitudinal sclerites (*Sc*₃) of unknown significance, attached to them by membrane. Ejaculatory sac small, in a ventral position. Spermatophore sac large, situated below penis. Phallotreme short, with a narrow distal opening and a short, slit-like, ventral one.

Epiphallus situated on dorso-proximal part of phallus, bridge-shaped. Ancorae small and broad; lophi lobiform; lateral plates large; anterior and posterior projections small. Oval sclerites present.

Tarbaleus cingalensis Kirby, 1914 (Pl. 48).

Ectophallic membrane forming a short basal fold. Cingulum well differentiated and sclerotised. Apodemes long, narrow, strongly sclerotised, joined by large, broad zygoma. Rami of cingulum with a direct connection with zygoma on its ventral side only; connected also with arch of cingulum and forming a peculiar structure consisting of a pair of strongly sclerotised ventro-lateral bars and membranous ventral and lateral sides, which are actually walls of phallotreme. With valves of cingulum these parts form a sheath-like structure completely covering apical valves of penis. Arch of cingulum represented by a strong sclerite, with a pair of strong branches connected above with ventral side of zygoma; on the sides they are joined to bar-like elongated rami. Posteriorly from arch of cingulum, there extends a pair of long valves, completely covering apical valves of penis and fused at apex, but separated along median dorsal line by a slit with serrated edges; this slit is the dorsal slit-like opening of phallotreme (Pl. 48, figs. g, j, o, dotted line). Valves of penis divided into basal and apical ones; basal valves comparatively short and slender, slightly broadened distally, gonopore processes absent; apical valves long and slender, almost completely fused, except for a short distance at dorso-proximal end, their apices broadened and forming a brushlike structure. Ejaculatory sac small, placed partly below, partly between, basal valves of penis. Spermatophore sac small, occupying a position above valves of penis. Phallotreme large and very broad; forming, with sclerotised bars of rami of cingulum below and laterally, and valves of cingulum above, a very broad distal opening continuous with ventro-distal slit-like openings (Pl. 48, fig. o, dotted line).

Epiphallus median, bridge-shaped. Ancorae broad; lophi very large, tooth-shaped; lateral plates indistinct. Oval sclerites present.

Subfamily ACRIDINAE (Pls. 51-59).

This subfamily is now considered to include only those genera which have been included previously in the tribe Acridini (Dirsh, 1950), with the addition of the former subfamily Oedipodinae, the reasons for which will be given below (p. 258).

The Acridinae are characterised by the absence of stridulatory pegs on the internal side of the hind femur and, in most cases, by the presence of a more or less well-developed intercalary vein in the medial area of the elytron.

The Acridinae are close to the Truxalinae, which differ from them by the presence of stridulatory pegs on the internal side of the hind femur and the absence of an intercalary vein in the medial area of the elytron. The other subfamily closely related to the Acridinae is the Catantopinae, which differ by the presence of the prosternal tubercle, the absence of an intercalary vein in the medial area of the elytron, and the presence of Comstock-Kellogg glands in the female (which were studied in a comparatively small number of genera, so that their taxonomic value was not fully established). The prosternal tubercle sometimes occurs also in the Acridinae (mostly in the group Pargae), while in some Catantopinae it may be reduced.

The phallic complex of the Acridinae is of the usual Acridid type, with minor deviations. The epiphallus is extremely uniform in the subfamilies Acridinae, Egnatiinae and Truxalinae, while differing from that in the other subfamilies of Acrididae in that the ancorae are articulated with the disc and the lophi are almost invariably lobiform, tending to become bilobate or trilobate. (In the group Pargae, the epiphallus is greatly simplified, and the ancorae are absent.)

The subfamily is divided here into three groups: Acridae, Pargae and Oedipodae.

Group Acridae (Pls. 51-54).

The group comprises numerous genera distributed over the whole world. The form of the phallic organ is usual for the subfamily.

Epiphalli vary within the group in secondary features. Bridge more or less narrow; ancorae varying from large to moderately small; lophi lobiform, sometimes with a small, almost finger-shaped lobe, sometimes more or less expanded or strongly elongated.

Acrida turrita (Linné, 1758) (Pl. 51).

Ectophallic membrane very thin; below strongly produced posteriorly forming a soft ventral lobe, covering underside of distal part of penis. Cingulum comparatively weakly sclerotised, consisting of a pair of long and strong apodemes; zygoma rather broad with a membranous posterior continuation covering arch and basal half of valves of cingulum; rami weakly sclerotised, rather broad, fused below. Arch of cingulum strong, with a pair of valves projecting behind and above apical valves of penis. Basal valves of penis comparatively strong, slightly widened distally, with a pair of strong gonopore processes; connected with apical valves by short, thin flexure. Apical valves rather long and narrow. Ejaculatory sac large, located below valves of penis. Spermatophore sac comparatively small, located partly below and partly between basal valves of penis and partly above its apical valves. Phallotreme not forming a slit-like ventral opening.

Epiphallus located on dorso-proximal end of phallic organ; bridge-shaped, with large ancorae articulated with disc; lophi large, thick, markedly differentiated from disc, lobiform; lateral plates large; anterior and posterior projections well developed. Oval sclerites present.

Group Pargi (Pl. 52, figs. 1-6).

This small group has a phallic organ of the type common to all Acrididae, but the epiphallus is characterised by the absence of ancorae (*Amphicremna* has rudimentary ones). This type of epiphallus is probably derived from the usual form by the loss of the ancorae.

The group consists of a few genera with very elongate bodies. Most of them possess a fairly well-developed prosternal tubercle.

Group Oedipodae (Pls. 55-59).

The genera formerly referred to the subfamily Oedipodinae do not differ in their phallic complex from members of the group Acridae.

In the past, Oedipodinae have been distinguished from Acridinae mainly by their general body shape, and more particularly by the frons being vertical instead of oblique. This character became quite untenable and Uvarov (1942) proposed the use of the presence of a stridulatory intercalary vein in the medial area of the elytra as the sole diagnostic feature of the Oedipodinae. However, a complete series of intermediates, from a well formed and serrate stridulatory vein to a very irregular and clearly non-functional structure, can be seen when the genera of the Acridae and the former Oedipodinae are considered together. Moreover, in some genera the intercalate vein may be more or less well-developed in the male, but absent in the female. This makes it impossible to retain the Oedipodinae as a subfamily any longer, and they are regarded as a group of the subfamily Acridinae.

The phallic organ and the epiphallus exhibit approximately the same range of variability as in the Acridae; only the Australian genus *Rapsilla* (Pl. 59 fig. 7) deviates in the structure of the epiphallus.

Oedipoda caerulescens (Linné, 1758) (Pl. 55).

Ectophallic membrane strongly produced posteriorly, forming a ventral lobe with slightly sclerotised sides. Cingulum strongly sclerotised. Apodemes broad, robust and rather short, with broadly divergent arms. Zygoma broad. Rami weakly sclerotised, connected below by thin membrane only. Arch of cingulum present, not connected with zygoma, with a pair of short, broad valves projecting above apical valves of penis. Valves of penis strongly sclerotised, robust. Basal valves broad, plate-like, expanded distally; gonopore processes well developed. Apical valves short, robust, excised at their apices. Basal and apical valves connected by a narrow, comparatively long, flexure. Ejaculatory sac large, located below valves of penis. Spermatophore sac comparatively large, located partly below and partly between basal valves of penis and partly above its apical valves. Phallotreme rather short and not forming a ventral slit-like opening.

Epiphallus located at dorso-proximal end of phallus, bridge-shaped. Ancorae large, articulated with disc; lophi large, thick, lobe-shaped, joined on internal sides to branches of bridge; lateral plates large; anterior and posterior projections well developed. Oval sclerites present.

Subfamily EGNATHINAE (Pl. 60, figs. 1-5).

This recently erected subfamily (Bey-Bienko, 1951) is very near to the Acridinae. The phallic complex does not show any substantial differences between the two subfamilies.

The principal external character of the subfamily is the marked shortening of the mesosternal interspace, owing to the strongly curved furcal suture. All its members, except *Leptoscirtus*, possess a peculiar stridulatory organ consisting of ridges on the sides of the abdominal tergites and specialised posterior tibial spines.

Subfamily EREMOCRILLINAE subfam. n. (Pl. 60, figs. 6, 7).

This subfamily consists of only two genera. Their phallic organs are of the usual type and they might be placed in the Truxalinae, but the epiphallus is quite unusual.

Epiphallus divided sagittally into two symmetrical halves connected only by thin membrane. Ancorae small, parallel to bridge, apices directed inwards; lophi tooth-shaped, with very acute spine-like apices; lateral plates large, with finger-shaped appendices directed inwards; anterior projections large, rounded, strongly projecting; posterior projections distinct.

The main external diagnostic character is the thick and short, strongly incurved, male cercus, quite unlike that of any species in the nearest subfamily, Truxalinae, with which Eremocrillinae share the stridulatory pegs on the internal side of the hind femur.

Subfamily TRUXALINAE (Pls. 60-65).

This subfamily is the former tribe Truxalini (Dirsh, 1950) of the Acridinae. The phallic organ in this subfamily differs from that in the Acridinae only in secondary characters and the epiphallus is as in the group Acridae.

The two subfamilies can be distinguished by the presence in the Truxalinae of stridulatory pegs on the internal side of the hind femur, these being absent in the Acridinae.

The subfamily cannot be divided into groups on the basis of the phallic complex.

Truxalis nasutus Linné, 1758 (Pl. 61).

Endophallic membrane forming a ventral lobe with a pair of lateral projections. Cingulum moderately sclerotised; apodemes comparatively weak and narrow; zygoma very broad and strong; rami soft, fused below, and forming medially a lobiform membranous fold, which projects behind and below sheath of apical valves of penis; this sheath is a continuation of rami of cingulum and is largely membranous, with a pair of lateral sclerotisations. Arch of cingulum absent. Penis moderately sclerotised; divided into basal and apical valves, connected by a rather long flexure; basal valves long, moderately widened, with comparatively long gonopore processes; apical valves short, with large, broad, dorsal appendices. Ejaculatory sac large, located below valves of penis. Spermatophore sac comparatively large, located partly below basal valves of penis, partly between them, and mostly above apical valves. Phallotreme short and broad, not forming a ventral slit-like opening.

Epiphallus located on dorso-proximal end of phallic organ, bridge-shaped. Ancorae large, articulated with disc; lophi large, thick, lobiform, located on branch of bridge; lateral plates large; anterior and posterior projections well developed. Oval sclerites present.

THE PHALLIC COMPLEX AS A TAXONOMIC CHARACTER.

The phallic complex was first used as a taxonomic character in the major classification of the family Acrididae in its former scope by Radclyffe-Roberts (1941). He divided the Acrididae into two groups: those with an open ejaculatory sac (Chasmosacci) and those with a closed one (Cryptosacci).

As has been shown above, the phallotreme always has a distal opening, which in Acridoid families often has a ventral continuation, the ventral slit-like opening; sometimes it also has a dorsal continuation, the dorsal slit-like opening (see *Gymnidium*, Pl. 24, and *Tarbaleus*, Pl. 48). The ventral slit-like opening together with the ectophallic membrane or the rami of the cingulum or with both, forms the cleft which Radclyffe-Roberts (1941) regarded as the opening of the ejaculatory sac (Chasmosacci group), but which is actually the ventral part of the opening of the phallotreme.

The ventral slit may be longer or shorter, depending on the length of the phallotreme, and if the spermatophore sac occupies a dorsal position above the ejaculatory sac, the slit (cleft) may begin at the distal end of the ejaculatory sac. In this case, it may create the impression of being the opening of the ejaculatory sac itself (see *Pamphagus*, Pl. 16). In the Pyrgomorphidae (Pl. 19) and Charilaidae (Pl. 15), where the phallotreme is shorter, the ventral slit is also shorter. It is shorter still in *Lentula* (Pl. 22), *Romalea* (Pl. 30) and *Catantops* (Pl. 32). In Acridinae (Pls. 51, 55) and Truxalinae (Pl. 61) it is completely absent.

There are, therefore, no grounds for regarding the presence or absence of the ventral slit-like opening of the phallotreme (cleft) as a major taxonomic character, as suggested by Radclyffe-Roberts.

As will be seen from the table (p. 265), the Acridoidea cannot be divided clearly in groups of families on the basis of any single character, since the characters of one group overlap those of others to some extent. Therefore, all grouping can be based only on combinations of characters.

One of the characters which can conveniently be used for major division and grouping of families is the ectophallus, which is of three principal types, as follows:

(1) Ectophallus rather simple, undifferentiated, or if more or less differentiated, still not forming a cingulum (Eumastacidae).

(2) Ectophallus forms a structure which may be regarded as a rudimentary cingulum (Pneumoridae, Xyronotidae and possibly Tanaoceridae).

(3) Ectophallus differentiated, forming a more or less complicated cingulum (Proscopiidae, Trigonopterygidae, Pyrgomorphidae, Lentulidae, Lathiceridae, Charilaidae, Pamphagidae, Pauliniidae, Ommexechidae and Acrididae. The cingulum of Proscopiidae, however, is less specialised than in the other families).

The form of the penis is another good character, which might be used for major grouping, but the families cannot be grouped on the basis of it in exactly the same order as on the basis of the ectophallus. There are the following types of penis:

(1) A single, rod-like sclerite (Proscopiidae).

(2) A single arched or U-shaped sclerite (most of the Eumastacidae).

(3) A pair of undivided sclerites or valves (Pyrgomorphidae, Lentulidae).

(4) A pair of valves, themselves divided into basal and apical parts but connected by a flexure (Ommexechidae, Acrididae, except Hemiaeridinae);

(5) A pair of valves, each completely divided into basal and apical parts (Trigonopterygidae, Lathiceridae, Charilaidae, Pamphagidae and Pauliniidae).

The characters offered by the apodemes and zygoma in the groups with the well developed cingulum may also be useful for the classification of the lower groups, since they are often very characteristic in structure, but they cannot be used for the higher taxonomic units. In the case of the Charilaidae, however, the apodemes are separated and the zygoma is absent; a pair of small lateral sclerites (Pl. 15) may either represent the zygoma, or be of independent origin.

The rami of the cingulum are the most variable parts of the ectophallus and only when they form a capsule-like structure, acting as a sheath to the apical valves of the penis, do they offer a very good character, as in the case of the Lentulidae.

The arch of the cingulum is an uncertain character since it may be present or absent in the same subfamily, and its usefulness for the lower taxonomic units could only be judged after an examination of all the known genera and species.

The ejaculatory sac is a fairly uniform structure, though it varies in size even in the same group of genera; in the Pauliniidae, however, it has a pair of lateral pockets, while in the Ommexechidae there are additional pockets and the surface is wrinkled in a peculiar way.

The spermatophore sac may be used as a taxonomic character according to its position, below, between, or above the valves of the penis. The dorsal position of the sac and the undivided valves of the penis are features which indicate relationship between the families Pyrgomorphidae and Lentulidae.

Excellent taxonomic characters are provided by the epiphallus, which in many cases can be used as a single character for differentiating families, some groups of families and some subfamilies.

The Pamphagidae (Pls. 17, 18) possess a shield-like epiphallus and a similar form occurs in the Tanaoceridae, Xyronotidae, Pneumoridae and Trigonopterygidae (Pl. 11); in the Charilaidae also (Pl. 27), there is a shield-like epiphallus, but with ventro-lateral appendices which do not occur in any other family. In Pyrgomorphidae (Pls. 20, 21), the epiphallus is bridge-shaped with dorso-lateral appendices which are absent in all other families. The epiphallus of Ommexechidae (Pl. 27) is very characteristic and differs from that of all other families except Pauliniidae by its lateral plates, which are separated from the bridge but have a membranous connection with it.

The bridge-shaped epiphallus is typical of the families Lathiceridae (Pl. 27), Acrididae (Pls. 31-65) and Lentulidae (Pl. 25), but within the family Acrididae there are subfamilies which may be clearly distinguished by the epiphallus alone. An example is the Calliptaminae, with the plate-like type of epiphallus (Pl. 45), which appears to be a derivation from the usual bridge-shaped form. The epiphallus in the subfamily Euryphyminae is characteristic (Pl. 46), being divided in the middle of the bridge into two parts. A highly peculiar type of divided epiphallus characterises the subfamily Eremogryllinae (Pl. 60). In the other subfamilies of the Acrididae the epiphallus varies greatly and cannot be used to distinguish them; in many cases, however, it helps to group the genera within the subfamilies. In the Eumastacidae, the epiphallus is extremely variable, but always quite different from that in other families.

The oval sclerites are present in five families and absent in nine. They may provide an additional character.

Generally speaking, both the phallic complex and the epiphallus alone provide very good characters for the higher taxonomic units. In some cases, these structures have been used in the past for characterising genera, species and even subspecies (Tarbinsky, 1931; Znoiko, 1928; Uvarov, 1943; Grassé and Hollande, 1946; Salfi, 1941). It is suggested that in future taxonomic work descriptions of the phallic complex, or at least of the epiphallus, should always be included.

As with any other morphological character, the phallic complex may be subject to certain intraspecific variability, particularly in the shape of the parts of the epiphallus; it is therefore essential, as always in taxonomic work, not to rely on single examples, but to study a series.

PHYLOGENETIC INTERRELATIONS.

The lack of palaeontological data makes it impossible to discuss with any certainty the relative age and phylogenetic interrelations of the families of Acridoidea. However, the study of the phallic complex makes it possible at least to put forward some suggestions.

In all families, the phallic complex is a complicated and specialised structure, but the modes of specialisation are different. The most specialised parts of it are the ectophallus, penis and epiphallus.

The trend of specialisation of the ectophallus represents a gradual differentiation. A very simple, sac-like ectophallus may be seen in some of the Eumastacidae. In the more specialised cases, the ectophallus forms a weakly sclerotised plate located on the dorsal side between the ectophallic membrane and the endophallus. This structure might be regarded as a primitive cingulum; it exists in the Pneumoridae, the Xyronotidae, possibly the Tanaoceridae, about which there is not enough information, and the Trigonopterygidae. The last named family, however, represents a far more advanced branch, highly specialised in other directions.

A further specialisation is seen when the ectophallus forms a distinct cingulum, which in most cases is itself highly differentiated. This occurs in the Proscopiidae, Pyrgomorphidae, Lathiceridae, Lentulidae, Charilaidae, Pamphagidae, Pauliniidae, Ommexechidae and Acrididae.

An undifferentiated ectophallus obviously represents the most primitive form of such structure, and the Eumastacidae should therefore be regarded as the most primitive branch of Acridoidea and of very ancient origin. Besides the primitive ectophallus, the Eumastacidae show primitiveness in the structure of the endophallus. Their penis is sometimes represented by a thickening or sclerotisation of the walls of the endophallic sac and in most cases consists of a single arch-shaped sclerite. Specialisation of secondary importance, however, frequently occurs in this family as may be seen in different types of sclerotisation of the ectophallus, which sometimes acquires a quite fantastic shape (*Erianthus*). The epiphallus in this family exhibits a wide range of diversity.

The phallic complex of the Pneumoridae is very poorly sclerotised and extremely primitive in its main features. However, the ectophallus forms a rudimentary plate-like cingulum indicating a slightly advanced trend of the

family, while the primitiveness of the other parts may be due to a partial degeneration.

All that is known about the family Xyronotidae is that it has the primitive cingulum and epiphallus of plate-like form. This allows it to be grouped with the Tanaoceridae and Pneumoridae. This grouping is justified not only by the common features of the phallic complex, but also by the fact that all three families possess stridulatory organs similar in general structure.

Very little can be said about the position of the Trigonopterygidae. The phallic complex in this family has many highly specialised features in the structure of the ecto- and endophallus, but the nature of this specialisation is quite different from that in other families. At the same time the form of the cingulum and the plate-like epiphallus suggest a remote connection with the above group of three families. It is probable that the Trigonopterygidae branched off from the same common stock, but much earlier.

The Eumastacidae, Tanaoceridae, Pneumoridae, Xyronotidae and Trigonopterygidae are characterised by primitive features, of which the absence or rudimentary form of the cingulum and the simple penis are the most important, and they form a group of families here called the Eumastacoid branch. This branch originated, probably very early, from a hypothetical pro-Acridoid stock, from which the Acridoid branch of families was also independently derived (Pl. 66).

The phallic complex of Proscopiidae is much more advanced than in the whole Eumastacoid branch, having a differentiated, though still rather primitive, cingulum consisting of a sac-like structure and a dorsal disc, but differing greatly from that in the Acridoid group of families. The endophallus is poorly developed, with a single-valved, rod-like penis. There are some indications of high specialisation in the secondary characters of the ecto- and endophallus, but the general primitiveness of the main characters is the dominating feature of the family. The Proscopiidae cannot be placed into one of the groups of families of Acridoidea and have probably branched off independently from the common pro-Acridoid stock.

The second Acridoid branch from the pro-Acridoid stock includes the families with differentiated cingulum which are more advanced than those of the Eumastacoid branch; further differentiation within this group of families mainly concerns the shape of the penis.

There are three main trends of specialisation of the penis in this group: (1) valves undivided; (2) valves connected by flexure, and (3) valves completely divided. It does not appear possible to decide which type is the primary one because whichever type is regarded as such, the arrangement would conflict with the other characters in the phallic complex and with external ones.

The three largest Acridoid families around which the smaller ones have usually been grouped are the Acrididae, Pamphagidae and Pyrgomorphidae.

A generally accepted view has been that the families Pamphagidae and Pyrgomorphidae are closely related and are more primitive than the Acrididae. This opinion was based mainly on the external characters, particularly the fastigial furrow and the shape of the base of the hind femur. These external characters are, however, not sufficiently reliable. The fastigial furrow occurs in some genera of Catantopinae (*Gemeneta*, *Sitalces*, *Ommatolampis*, *Rhachicreagra*, *Psiloscoirtus*) of Acrididae, while it occasionally becomes obsolete in some

Pamphagidae (in many species of *Tmethis* and related genera). The structure of the hind femur is variable in the Charilaidae, a family related to Pamphagidae, the genus *Pamphagodes* possessing a transitional type of femur, while in *Charilaus* and *Hemicharilaus* it is of the Pamphagoid type. In some genera of Romaleinae there is also a tendency towards transitions between the two types of femur (Uvarov, 1943). Thus, neither of these external characters is of value as evidence of close relationship between Pamphagidae and Pyrgomorphidae. On the other hand, the phallic complex in the two families is different in almost every respect (see Table p. 265). The penis, the ectophallus and the epiphallus are quite distinct and there is no suggestion of the existence of intermediates between them. There is every reason to regard the characters of the phallic complex of Pamphagidae and Pyrgomorphidae as of greater phylogenetic value than their external features, which may well be the result of secondary adaptations.

The family Acrididae, with the flexured penis valves, might seem to occupy an intermediate position between the Pamphagidae (divided valves) and Pyrgomorphidae (undivided valves), but this view is untenable because of the great difference in the other features of the phallic complex and in many external characters. It seems reasonable to regard the Pamphagidae, Pyrgomorphidae and Acrididae as well defined families, no more related to each other than to the other Acridoid families. They may have originated independently from a common pro-Acridoid stock.

The Charilaidae appear to be related to the Pamphagidae. The penis has divided valves in both families, but in the Charilaidae they are not articulated. The other characters of the phallic complex are rather divergent. The epiphallus is similar in the two families, but in the Charilaidae it has ventro-lateral appendices which are absent in the Pamphagidae. Both families have a fastigial furrow, and a specialised hind femur is found in two out of the three genera of the Charilaidae. All this suggests a closer connection between these two families than between either of them and other families of the Acridoid branch, but the differences are sufficient to separate them.

The family Lathiceridae presents a mixture of primitive and advanced characters. The divided penis, the position of the spermatophore sac, the bridge-shaped epiphallus and the presence of oval sclerites may be regarded as advanced characters, while the plate-like cingulum and the absence of gonopore processes may be looked upon as primitive features. The external characters of this family also present a number of both specialised and degenerate features. It may be suggested that the Lathiceridae arose from the common Acridoid stock independently of the Pamphagidae.

In the structure of the phallic complex, the Lentulidae have more characters in common with the Pyrgomorphidae than with any other Acridoid family. They also have the undivided valves of the penis, the dorsal spermatophore sac and no gonopore processes, but their ectophallus has a cingulum, and, although the epiphallus is bridge-shaped as in the Pyrgomorphidae, it has no dorso-lateral appendices but is provided with ancorae and oval sclerites. The external characters of these two families, however, are very different (see p. 244), and it is reasonable to suggest a very early derivation of them from the common stock.

The family Ommexechidae, with flexured penis valves and without gonopore processes, might appear to be close to the Pyrgomorphidae, but all the other

characters of the phallic complex are very different. The strongly differentiated cingulum and the position of the spermatophore sac appear to connect it with the Acrididae, but the ejaculatory sac is quite peculiar, with additional pockets; the epiphallus is also of unique shape, with separated lateral plates and large oval sclerites. The confusing features of this family and the number of peculiar ones, suggest that this family probably originated independently from the common pro-Acridoid stock.

The position of the Pauliniidae is very obscure. The completely divided valves of the penis might suggest a connection with the Pamphagoid group, but the presence of oval sclerites and the structure of the ejaculatory sac do not support this view. The external characters, including the absence of the fastigial furrow and the Acridoid type of hind femur, are quite different from those of the Pamphagidae. All these characters in combination make it impossible to connect Pauliniidae with any of the existing families, but the similarity in the structure of the epiphallus suggests that they may have originated from the same branch as the Ommexechidae.

The family Acrididae, with its numerous subfamilies, is distinct from all the others. In its subfamilies the phallic complex exhibits a great range of variability in the secondary characters, but it is reasonably uniform in the principal ones. All the subfamilies of the Acrididae are distinguishable by their secondary external characters, but the phallic complex shows in its principal parts the same specialised characters throughout the whole family.

Comparative table of the main phallic characters.

Family.	Ectophallus.	Cingulum.	Valves of penis.	Epiphallus.	Oval sclerites.
Eumastacidae	Undifferentiated	Absent	Mainly single, arch-shaped	Great diversity of form	Absent
Tanaoceridae	?	?	?	Plate-like	„
Pneumoridae	Weakly differentiated	Rudimentary	Paired, rod-shaped undivided	„	„
Xyronotidae	Weakly differentiated	Rudimentary	?	„	„
Trigonopterygidae	Differentiated	Differentiated	Paired, divided	„	„
Proscopiidae	„	Differentiated (primitive)	Single, rod-shaped	Bridge-shaped	„
Charilaidae	„	Differentiated	Paired, divided	Shield-like	„
Pamphagidae	„	„	do.	„	„
Pyrgomorphidae	„	Capsule-like	Paired, undivided	Bridge-shaped	„
Lentulidae	„	Differentiated	„	„	Present
Lathiceridae	„	Plate-like	Paired, divided	„	„
Ommexechidae	„	Differentiated	Paired, flexured	„	„
Pauliniidae	„	„	Paired, divided	„	„
Acrididae	„	„	Paired, flexured	„	„

The most advanced subfamily is the Truxalinae, in which the phallic complex is indistinguishable from that of the Acridinae. The subfamily Hemiacidinae has divided valves of penis. This character approximates it to the Pamphagoid group, but all the other characters contradict this, and make the Hemiacidinae nearer to the Acrididae. The presence in the Hemiacidinae of a tendency towards the formation of a flexure-like connection between the valves of the penis, and in some cases even the presence of a rather distinct flexure, while some of the genera in Catantopinae tend towards the loss of the flexure, indicate the possibility of a variability of this character in the Acrididae. For this reason, the Hemiacidinae may be regarded only as a subfamily of Acrididae.

The hypothetical interrelations between the families of Acridoidea are represented on Pl. 66.

KEY TO FAMILIES* BASED ON THE PHALLIC COMPLEX

* Except *Tanaoceridae* and *Xyronotidae*, the information on which is incomplete.

- 1 (2) Ectophallus undifferentiated, not forming a cingulum. **Eumastacidae**
- 2 (1) Ectophallus forming a cingulum.
- 3 (6) Ectophallus forming a rudimentary plate- or disc-like cingulum.
- 4 (5) Endophallus simple, the ejaculatory sac and spermatophore sacs hardly differentiated. Penis consisting of a pair of valves . . . **Pneumoridae**
- 5 (4) Endophallus specialised, with the sacs differentiated. Penis consisting of a single sclerite . . . **Proscopiidae**
- 6 (3) Ectophallus forming a specialised cingulum.
- 7 (8) Whole phallic complex reversed, with penis directed towards anterior end of body . . . **Trigonopterygidae**
- 8 (7) Phallic complex in normal position, with penis directed towards posterior end of body.
- 9 (12) Valves of penis undivided. Spermatophore sac in dorsal position above valves of penis.
- 10 (11) Cingulum capsule-like. Epiphallus without ancorae, with dorso-lateral appendices. Oval sclerites absent. . . **Pyrgomorphidae**
- 11 (10) Cingulum differentiated. Epiphallus with ancorae, without appendices. Oval sclerites present. . . **Lentulidae**
- 12 (9) Valves of penis divided into basal and apical ones, or connected by a flexure.
- 13 (20) Valves of penis divided.
- 14 (15) Cingulum plate-like. Epiphallus bridge-shaped, without ancorae. Oval sclerites present. . . **Lathiceridae**
- 15 (14) Cingulum differentiated. Epiphallus shield-like, with ancorae and without oval sclerites; or bridge-shaped and with oval sclerites, but then lateral plates connected with bridge by membrane.
- 16 (19) Epiphallus shield-shaped. Oval sclerites absent.
- 17 (18) Zygoma absent. Apodemes separated. Basal and apical valves of penis not articulated. Epiphallus with ventro-lateral appendices **Charilaidae**
- 18 (17) Zygoma present, connecting apodemes. Basal and apical valves of penis articulated. Epiphallus without appendices. . **Pamphagidae**
- 19 (16) Epiphallus bridge-shaped; lateral plates connected with bridge by membrane. Oval sclerites present. . . **Pauliniidae**

- 20 (13) Valves of penis connected by flexure.
 21 (22) Ejaculatory sac with a pair of additional pockets. Lateral plates of epiphallus connected with bridge by membrane. **Ommexechidae**
 22 (21) Ejaculatory sac simple, without additional pockets. Lateral plates of epiphallus fused with bridge. **Acrididae**

KEY TO FAMILIES BASED ON EXTERNAL CHARACTERS.

- 1 (2) Brunner's organ of hind femur absent. Body very narrow, strongly elongated, stick-like. Hind legs almost cursorial.—(South America). **Proscopiidae**
 2 (1) Brunner's organ of hind femur present. Body normally of the usual Acridoid shape. Hind legs saltatorial.
 3 (4) Head compressed in frontal direction. Basal segment of hind tarsus above often with serrated lateral edges. Third, fourth or fifth antennal segment from the apex, often with a small tubercle or spine (antennal organ).—(Whole World). **Eumastacidae**
 4 (3) Head not compressed in frontal direction. Basal segment of hind tarsus never serrated dorsally. Antennal organ absent.
 5 (10) Second abdominal tergite or fused second and third of the male with a row of stridulatory ridges laterally.
 6 (7) Antenna in male longer than body, in female about the same length as body. Stridulatory organ on second abdominal tergite of male consisting of a cylindrical ridge densely covered with fine transverse ridges.—(N. America) **Tanaoceridae**
 7 (6) Antenna shorter than, or as long as, head and pronotum together. Stridulatory organ consisting of a row of small separate ridges.
 8 (9) Male body very strongly inflated (functioning as a resonator). Frons flat, vertical.—(Africa) **Pneumoridae**
 9 (8) Body in both sexes thin, compressed laterally. Head conical, with incurved frons. (N. America) **Xyronotidae**
 10 (5) Abdominal tergites without stridulatory ridges.
 11 (22) Fastigial furrow present.
 12 (13) Elytra narrow at base, strongly widening towards apex: radius and media fused or weakly separated. Upper basal lobe of hind femur longer than lower one. Tympanum absent.—(S. E. Asia). **Trigonopterygidae**
 13 (12) Elytra of normal Acridoid type, with normal venation. Upper basal lobe of hind femur shorter than lower one or both of equal length. Tympanum normally present.
 14 (15) Pronotum with a double median carina.—(S. and S.W. Africa). **Charilaidae**
 15 (14) Pronotum with a single median carina, or without any carina.
 16 (21) Upper basal lobe of hind femur shorter than lower one.
 17 (18) Head slightly prognathous; on sides of frontal ridge a pair of deep grooves, into which the short antennae fit closely. Tympanum absent.—(S. and S.W. Africa) **Lathiceridae**
 18 (17) Head not at all prognathous; antennal grooves absent. Tympanum normally present.
 19 (20) Upper fastigial foveolae absent. Krauss's organ normally present.—(Africa, Asia, Europe). **Pamphagidae**
 20 (19) Upper fastigial foveolae present. Krauss's organ absent.—(Whole World) **Pyrgomorphidae**

- 21 (16) Basal lobes of hind femur of equal length.—(S. America) . . . **Ommexechidae**
- 22 (11) Fastigial furrow absent. Upper basal lobe of hind femur longer than lower one.
- 23 (24) Wings always absent. Tympanum absent. Male subgenital plate compressed laterally.—(S., S.W. and S.E. Africa). **Lentulidae**
- 24 (23) Wings normally present. Tympanum normally present. Male subgenital plate usually not compressed.
- 25 (26) Hind tibia with strongly expanded lateral edges.—(S. America). **Pauliniidae**
- 26 (25) Hind tibia of normal shape or with slightly broadened lateral edges.—(Whole World) . . . **Acrididae**

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EXPLANATIONS OF PLATES

Key to abbreviations on pp. 225-229.

PLATE 1

1. Diagram of phallic complex of most primitive form.
2. Diagram of phallic complex of highly specialised form.
- 3-5. Epiphallus of *Schistocerca gregaria* from different viewpoints: 3, lophi in vertical position; 4, lophi in horizontal position; 5, view in profile.
6. Phallic complex of *Locusta migratoria* in erected position.
7. Posterior view of end of abdomen of *Amblyphymus rubripes*, showing position of genital complex before copulation.

PLATE 2

Diagrammatic representation of: 1, undivided valve of penis; 2, valve of penis with flexure; 3, fully divided valve of penis; 4, penis and cingulum of simple form; 5, ditto, but cingulum with dorsal valve; 6, ditto, but cingulum with ventral valve; 7, penis with cingulum forming sheath, but apex of penis projecting; 8, ditto, but sheath completely covering penis; 9, penis, with arch of cingulum and valve derived from it; 10, valve of penis with dorsal appendix; 11, ditto, but with ventral appendix.

PLATE 3

Different types of epiphallus: 1, 7, 8, bridge-like; 2, bridge-like, with dorso-lateral appendices; 3, bridge-like, with divided bridge; 4, shield-like, with ventro-lateral appendices; 5, 9, plate-like; 6, shield-like; 10, bridge-like, with separated lateral plates.

PLATE 4

Phallic complex of *Gomphomastax clavata* (Ostr.): A, B, C, whole complex, dorsal, ventral and lateral views; D, E, F, endophallus, dorsal, ventral and lateral views; G, penis, dorsal view; H, endophallic sac, lateral view, diagrammatic; I, epiphallus, dorsal view.

PLATE 5

Phallic complex of *Biroella gracilis* C. Bol.: A, B, C, whole complex, dorsal, ventral and lateral views; D, E, F, endophallus, dorsal, ventral and lateral views; G, penis, dorsal view; H, endophallic sac, lateral view, diagrammatic; I, epiphallus, dorsal view.

PLATE 6

Phallic complex of *Moraba* sp.: A, B, C, whole complex, dorsal, ventral and lateral views; D, apex of aedeagus, ventral view; E, F, G, endophallus, dorsal, ventral and lateral views; H, penis, dorsal view; I, endophallic sac, diagrammatic; J, epiphallus, dorsal view.

PLATE 7

Phallic complex of *Erianthus guttatus* Westw.: A, whole complex, dorsal view; B, ditto, but epiphallus removed; C, D, whole complex, ventral and lateral views; E, endophallic sac, lateral view, diagrammatic; F, epiphallus, distal view.

PLATE 8

Phallic complex of *Erucius dimidiatipes* I. Bol.: A, B, whole complex, dorsal view (in B, apical part of ectophallus extended and epiphallus turned backwards); C, D, whole complex, ventral and lateral views (in D, apical part of ectophallus extended); E, apical end of complex, posterior view (posterior end of epiphallus in vertical position); F, G, H, endophallus, dorsal, ventral and lateral views; I, J, penis, dorsal and lateral views.

PLATE 9

Phallic complex of *Euschmidia burri* Uv.: A, B, C, whole complex, dorsal, ventral and lateral views; D, E, F, endophallus, dorsal, ventral and lateral views; G, H, I, penis, dorsal, ventral and lateral views; J, endophallic sac, lateral view, diagrammatic; K, epiphallus.

PLATE 10

Phallic complex of *Physemacris variolosa* L.: A, B, C, whole complex, dorsal, ventral and lateral views; D, ectophallus (epiphallus removed), dorso-posterior view; E, F, endophallus, lateral and dorsal views.

PLATE 11

Epiphalli. Family Tanaoceridae: 1, *Tanaocerus koebelei* Bruner 1906. Family Xyronotidae: 2, *Xyronotus aztecus* I. Bolivar 1884. Family Trigonopterygidae: 3, *Trigonopteryx hopei* Westwood, 1841; 4, *Systella rafflesii* Westwood 1841. Family Pneumoridae: 5, *Physemacris variolosa* (Linné 1758); 6, *Bullacris longicornis* (Stål 1873); 7, *Pneumora inanis* (Fabricius 1775); 8, *Shortridgea absidata* (Karsch 1896).

PLATE 12

Phallic complex of *Trigonopteryx hopei* Westw.: A, phallic complex *in situ* (penis directed anteriorly); B, C, D, whole complex, dorsal, ventral and lateral views; E, F, phallic organ, dorsal and ventral views, epiphallus and ectophallic membrane removed; G, H, I, phallic organ, ventral and lateral views, zygoma and apodemes removed (in I, pouch of phallus shifted upwards); J, K, L, endophallus, dorsal, ventral and lateral views; M, section of endophallus and endophallic sacs, diagrammatic; N, spermatophore.

PLATE 13

Phallic complex of *Systella rafflesii* Westw.: A, B, whole complex, dorsal and ventral views; C, D, phallic organ, lateral and dorsal views, epiphallus removed; E, F, phallic organ, dorsal view, epiphallus, ectophallic membrane, zygoma and apodemes removed (in F, distal end raised to show apical valves of penis and sclerotised parts of phallotreme); G, as for E, but ventral view; H, phallic organ, lateral view, ectophallic membrane removed; I, phallic organ, lateral view, in longitudinal section (zygoma and apodemes removed); J, diagram of endophallic sacs, in profile, and position of aedeagal chamber (dotted line shows opening of chamber); K, aedeagal chamber separately; L, apical valves of penis, dorso-apical view.

PLATE 14

Phallic complex of *Proscopia scabra* Klug: A, B, C, whole complex, dorsal, ventral and lateral views; D, E, F, endophallus with part of ectophallus, dorsal, ventral and lateral views (in E, the whole structure slightly inclined forwards); G, H, I, endophallus, dorsal, ventral and lateral views; J, endophallus without endophallic tube; K, epiphallus, dorsal view.

PLATE 15

Phallic complex of *Charilaus carinatus* St.: A, B, whole complex, dorsal and ventral views; C, D, E, phallic organ, epiphallus and ectophallic membrane removed, dorsal, ventral and lateral views; F, G, H, as for E, but apodemes and small sclerites (*Ascl*) removed, lateral, dorsal and ventral views; I, as for F, but sacs removed and only sclerotised parts left; J, endophallic sacs in profile, diagrammatic.

PLATE 16

Phallic complex of *Pamphagus elephas* (L.): A, whole complex, dorsal view; B, C, D, phallic organ (without epiphallus), dorsal, ventral and lateral views; E, sclerotised parts of phallic organ (sacs removed); F, penis, lateral view; G, endophallic sacs in profile, diagrammatic.

PLATE 17

Epiphalli of the family Pamphagidae: 1, *Sarissurea stuhlmanniana* (Karsch 1896); 2, *Hoplolopha horrida* (Burmeister 1838); 3, *Cultriotus luanensis* Uvarov 1953; 4, *Trachypetrella anderssonii* (Stål 1875); 5, *Aphantotropis connectens* Uvarov 1924; 6, *Prionotropis appula* (Costa 1836); 7, *Adephagus cristatus* (Burmeister 1838); 8, *Eremopeza cinerascens* (Stål 1875); 9, *Tuarega insignis* (Lucas 1851); 10, *Asiotmethis muricatus*

(Pallas 1771); 11, *Tmethis cisti* (Fabricius 1787); 12, *Eremocharis granulosa* (Walker 1871); 13, *Eremotmethis carinatus* (Fabricius 1775); 14, *Utubius zahrae* Uvarov 1936; 15, *Strumiger desertorum* Zubowsky 1896.

PLATE 18

Epiphalli of the family Pamphagidae: 1, *Batrochetrix pistrinarius* (Saussure 1884); 2, *Batrachornis perlodes* Saussure 1884; 3, *Eremotettix capensis* Miller 1932; 4, *Paranocarodes straubei* (Fieber 1853); 5, *Nocarodes serricollis* Fischer v. Waldheim 1846; 6, *Nocaracris rubripes* (Fischer v. Waldheim 1846); 7, *Ocneridia canonica* (Fischer 1853); 8, *Pamphagus elephas* (Linné 1758); 9, *Haplotropis brunneriana* Saussure 1888; 10, *Ocneropsis bethlemita* (I. Bolivar 1893); 11, *Orchamus gracilis* (Brunner v. Wattenwyl 1882); 12, *Acinipe hesperica* Rambur 1838; 13, *Euryparyphes flexuosus* Uvarov 1927; 14, *Prionosthenus galericulatus* (Stål 1876); 15, *Tropidauchen marginatum* I. Bolivar 1912; 16, *Akicera fusca* (Thunberg 1815); 17, *Finotia maxima* Jannone 1937.

PLATE 19

Phallic complex of *Phymateus morbillosus* (L.): A, whole complex, dorsal view; B, C, D, phallic organ, dorsal ventral and lateral views; E, F, endophallus, dorsal and lateral views; G, H, penis, dorsal and lateral views; I, endophallic sacs in profile, diagrammatic; J, distal opening of ejaculatory duct.

PLATE 20

Epiphalli of the family Pyrgomorphidae: 1, *Colemanius sphenarioides* I. Bolivar 1910; 2, *Desmoptera molucensis* I. Bolivar 1905; 3, *Mekongiana kingdonia* Uvarov 1937; 4, *Stibarosterna serrata* Uvarov 1953; 5, *Ochrophlebia cafer* (Linné 1764); 6, *Scutillia varrucosa* Sjostedt 1921; 7, *Anandalea robinsoni* I. Bolivar 1905; 8, *Sphenarium mexicanum* Saussure 1859; 9, *Humpatella severini* I. Bolivar 1904; 10, *Prosphena scudderi* I. Bolivar 1884; 11, *Tanita obesa* Uvarov 1953; 12, *Stenoxyphus aurantiacus* (Karsch 1896); 13, *Tagasta marginella* (Thunberg 1815); 14, *Monistria pustulifera* (Walker 1871); 15, *Orthacris filiformis* I. Bolivar 1884; 16, *Parasphena pulchripes* (Gerstaecker 1869); 17, *Tenuitarsus* sp.; 18, *Geloius finoti* I. Bolivar 1905; 19, *Laufferia chloronata* (I. Bolivar 1889); 20, *Popovia salvadorae* Uvarov 1952.

PLATE 21

Epiphalli of the family Pyrgomorphidae: 1, *Aularches miliaris* (Linné 1758); 2, *Taphronota calliparea* (Schaum 1853); 3, *Zurysites squalinus* (I. Bolivar 1884); 4, *Pyrgomorphella granosa* (Stål 1876); 5, *Chrotogonus* sp.; 6, *Pyrgomorpha conica* (Olivier 1791); 7, *Leptea debilis* Finot 1894; 8, *Zonocerus elegans* (Thunberg 1815); 9, *Maura rugulosa* I. Bolivar 1884; 10, *Parapetasia impotens* (Karsch 1888); 11, *Phymateus purpurascens* Karsch 1896; 12, *Tapesia spumans* (Thunberg 1787); 13, *Poecilocerus pictus* (Fabricius 1793); 14, *Maphyteus leprosus* (Fabricius 1773); 15, *Betisca pedestris* (Erichson 1842); 16, *Atractomorpha crenulata* (Fabricius 1793); 17, *Omura congrua* (Walker 1870).

PLATE 22

Phallic complex of *Lentula obtusifrons* St.: A, B, C, whole complex, dorsal, ventral and lateral views; D, E, F, endophallus, dorsal, ventral and lateral views; G, as for E, but ejaculatory sac removed and valves of penis disconnected and spread laterally; H, I, penis, dorsal and lateral views; J, endophallic sacs in profile, diagrammatic.

PLATE 23

Phallic complex of *Eremidium equeuleus* Karsch: A, B, C, whole complex, dorsal ventral and lateral views (in C, epiphallus removed); D, E, F, phallic organ, epiphallus and ectophallic membrane removed, dorsal, ventral and lateral views; G, H, I, endophallus, dorsal, ventral and lateral views; J, K, L, penis, dorsal, ventral and lateral views; M, endophallic sacs in profile, diagrammatic.

PLATE 24

Phallic complex of *Gymnidium turbinatum* Karsch: A, whole complex, dorsal view; B, C, phallic organ, epiphallus and endophallic membrane removed, dorsal and lateral views; D, E, phallic organ, zygoma and apodemes removed, dorsal and ventral views; F, G, H, endophallus, lateral, dorsal and ventral views; I, J, K, penis, lateral, dorsal and ventral views; L, endophallic sacs in profile, diagrammatic.

PLATE 25

Epiphalli of the family Lentulidae: 1, *Lentula obtusifrons* Stål 1878; 2, *Paralentula candidoi* (Ramme 1929); 3, *Sygrus rehni* Dirsh 1956; 4, *Rehnula insolita* (Rehn 1914); 5, *Usambilla* sp.; 6, *Basutacris scotti* Dirsh 1953; 7, *Nyassacris uvarovi* Ramme 1929; 8, *Mecostibus mopanei* Uvarov 1953; 9, *Eremidium equuleus* Karsch 1896; 10, *Shelfordites nanus* Uvarov 1925; 11, *Gymnidium turbinatum* Karsch 1896; 12, *Devylideria coryphistoides* Sjöstedt 1923; 13, *Betiscoides meridionalis* Sjöstedt 1923; 14, *Swaziacris burtti* Dirsh 1953; 15, *Rhcnoderma humile* Rehn 1905.

PLATE 26

Phallic complex of *Batrachidacris rubridens* (Uvarov): A, B, whole complex, dorsal and lateral views (in B, epiphallus removed); C, D, phallic organ, dorsal and ventral views, epiphallus and ectophallic membrane removed; E, F, G, endophallus, dorsal, ventral and lateral views; H, I, J, penis, sacs removed, dorsal, ventral and lateral views; K, endophallic sacs in profile, diagrammatic.

PLATE 27

Epiphalli. Family Charilaidae: 1, *Charilaus curvicollis* Karny 1910; 2, *Charilaus carinatus* Stål 1875; 3, *Hemicharilaus monomorphus* (Uvarov 1929). Family Lathiceridae: 4, *Batrachidacris rubridens* (Uvarov 1929); 5, *Lathicerus cimex* Saussure 1888. Family Ommexechidae: 6, *Graea horrida* Philippi 1863; 7, *Graea monstrosa* Bruner 1900; 8, *Spathalium hispidum* Bruner 1900; 9, *Ommexecha servillei* Blanchard 1836; 10, *Parossa bimaculata* Giglio-Tos 1894. Family Pauliniidae: 11, *Paulinia acuminata* (De Geer 1773).

PLATE 28

Phallic complex of *Ommexecha servillei* Blanch.: A, whole complex, dorsal view; B, C, phallic organ, epiphallus and part of ectophallic membrane removed, ventral and lateral views; D, E, F, phallic organ, epiphallus and ectophallic membrane removed, dorsal, ventral and lateral views; G, H, I, endophallus, lateral, dorsal and ventral views; J, K, L, penis, lateral, dorsal and ventral views; M, endophallic sacs in profile, diagrammatic.

PLATE 29

Phallic complex of *Paulinia acuminata* (De Geer): A, B, whole complex, dorsal and ventral views (in B, epiphallus and part of ectophallic membrane removed); C, D, E, phallic organ, lateral, dorsal and ventral views, ectophallic membrane removed; F, G, H, endophallus with arch of cingulum, lateral, dorsal and ventral views; I, J, K, penis, lateral, dorsal and ventral views; L, endophallic sacs in profile, diagrammatic.

PLATE 30

Phallic complex of *Romalea microptera* (Beauv.): A, B, whole complex, dorsal and ventral views (in B, epiphallus and part of ectophallic membrane removed); C, D, E, phallic organ, dorsal, ventral and lateral views, epiphallus and ectophallic membrane removed; F, G, H, endophallus, dorsal, ventral and lateral views; I, J, K, penis, dorsal, ventral and lateral views; L, endophallic sacs in profile, diagrammatic.

PLATE 31

Epiphalli of the subfamily Romaleinae: 1, *Alcamenes cristatus* Bruner 1906; 2, *Chromacris miles* (Drury 1773); 3, *Colpophpha obsoleta* (Serville 1831); 4, *Dracotettix monstrosus* Bruner 1889; 5, *Cibotopteryx variegata* Rehn 1905; 6, *Zoniopoda exilipes* Bruner 1906; 7, *Romalea microptera* (Beauvais 1805); 8, *Tropidostethus bicarinatus* Philippi 1863; 9, *Pelecinotus brachypterus* I. Bolivar 1902; 10, *Xyleus laevipes* (Stål 1878); 11, *Procolpia minor* Giglio-Tos 1894; 12, *Brachystola magna* (Girard 1854); 13, *Phrymolettix ichivavensis* (Haldeman 1852); 14, *Prionolopha serrata* (Linné 1758); 15, *Taeniopoda auricornis* (Walker 1870); 16, *Coryacris angustipennis* (Bruner 1900); 17, *Batrachacris viridis* (Blanchard 1851); 18, *Aeolacris bella* Rehn 1909; 19, *Agriacris trilineata* (Serville 1831); 20, *Kabulia evansi* Uvarov 1931; 21, *Tythotyle maculata* (Bruner 1889); 22, *Munatia decorata* Carl 1916; 23, *Eutropidacris collaris* (Stoll 1813); 24, *Tilamacris carinata* (Stoll 1813); 25, *Lophacris olfersii* (Burmeister 1838); 26, *Acrostegastes* sp.; 27, *Tropidacris latreillei* (Perty 1832); 28, *Teratodes monticollis* (Gray 1832).

PLATE 32

Phallic complex of *Catantops melanostictus* Schaum: A, whole complex, dorsal view; B, C, phallic organ, ventral and lateral views, epiphallus and part of ectophallic membrane removed; D, E, F, phallic organ, dorsal, ventral and lateral views, epiphallus and ectophallic membrane removed; G, H, I, endophallus, dorsal, ventral and lateral views; J, K, L, penis, dorsal, ventral and lateral views; M, endophallic sacs in profile, diagrammatic; N, flexure, connecting basal and apical valves of penis.

PLATE 33

Epiphalli of the group Cyrtacanthacres: 1, *Rhytidacris tectifera* (Karsch 1896); 2, *Chondracris rosea* (De Geer 1773); 3, *Valanga nigricornis* (Burmeister 1838); 4, *Acridoderes crassus* I. Bolivar 1889; 5, *Acanthacris ruficornis* (Fabricius 1787); 6, *Kraussaria angulifera* (Krauss 1877); 7, *Melicodes vittaticollis* (Stål 1877); 8, *Rhadinacris schistocercoides* (Branesik 1893); 9, *Austracris guttulosa* (Walker 1870); 10, *Nomadacris septemfasciata* (Serville 1839); 11, *Pachynotacris amethystina* (I. Bolivar 1908); 12, *Phyzacra strenua* (Walker 1870); 13, *Cyrtacanthacris tatarica* (Linné 1758); 14, *Pachyacris vinosa* (Walker 1870); 15, *Patanga succincta* (Linné 1763); 16, *Adramita arabica* (Uvarov 1930); 17, *Ornithacris cyanea* (Stoll 1813); 18, *Anacridium aegyptium* (Linné 1764); 19, *Gowdeya picta* Uvarov 1923; 20, *Bryophyma debilis* (Karsch 1896); 21, *Willemsea bimaculata* (Willemse 1922); 22, *Schistocerca gregaria* (Forskål 1775); 23, *Orthacanthacris humilicrus* (Karsch 1896).

PLATE 34

Epiphalli of the group Catantops: 1, *Staurocleis magnifica* Uvarov 1923; 2, *Oxycardenius tinctipennis* Uvarov 1953; 3, *Cardeniopsis nigropunctatus* (I. Bolivar 1881); 4, *Paracardenius lineatus* Uvarov 1953; 5, *Trichocatantops tukuyensis* (Miller 1925); 6, *Madimbana madimbana* (Giglio-Tos 1907); 7, *Pyrganthermus cephalicus* (I. Bolivar 1889); 8, *Anthermus granosus* Stål 1878; 9, *Catantopsilus taeniolatus* (Karsch 1893); 10, *Anacatantops notatus* (Karsch 1891); 11, *Catantopsis opomaliiformis* I. Bolivar 1912; 12, *Phaeocatantops decoratus* (Gerstaecker 1869); 13, *Catantops melanostictus* Schaum 1853; 14, *Oxycatantops congoensis* (Sjostedt 1929); 15, *Brachycatantops emalicus gracilis* Dirsh 1956; 16, *Pezocatantops lobipennis* (Sjostedt 1933); 17, *Exopropacris rehni* (Sjostedt 1923); 18, *Xenocatantops humilis* (Serville 1839); 19, *Pachycatantops crassipes* (Ramme 1929); 20, *Microcatantops brachypterus* Ramme 1929; 21, *Pirithoicus ophthalmicus* (Karny 1907); 22, *Crobylostenus indecisus* (I. Bolivar 1912); 23, *Orbillus coeruleus* (Drury 1773); 24, *Anapropacris elegantula* (I. Bolivar 1908); 25, *Eupropacris ornatus* (Karny 1907); 26, *Parapropacris rhodopterus* (Uvarov 1923); 27, *Stenocatantops splendens* (Thunberg 1815); 28, *Stenocroblyus cervinus* Gerstaecker 1869.

PLATE 35

Epiphalli of the group Podismae: 1, *Melanoplus femur-rubra* (De Geer 1773); 2, *Podisma pedestris* (Linné 1758); 3, *Dendrotettix quercus* Riley 1886; 4, *Eirenephilus debilis* Ikonnikov 1911; 5, *Caudellacris omei* Rehn and Rehn 1939; 6, *Tonkinacris decorata* Carl 1916; 7, *Campylacantha olivacea* (Scudder 1875); 8, *Odontopodisma salamandra* (Fischer 1853); 9, *Micropodisma koenigi* (Burr 1913); 10, *Pseudoprumna baldensis* (Krauss 1883); 11, *Miramella solitaria* (Ikonnikov 1911); 12, *Zubovskya parvula* (Ikonnikov 1911); 13, *Oropodisma parnassica* (Scudder 1898); 14, *Primnoa primnoa* (Fischer v. Waldheim 1846); 15, *Pachypodisma lezgina* (Uvarov 1917); 16, *Prumnacris rainierensis* (Caudell 1907); 17, *Asemoplus montanus* (Bruner 1885); 18, *Paroxya atlantica* Scudder 1877; 19, *Philocleon nigrovittatus* (Stål 1875); 20, *Kingdonella pictipes* Uvarov 1935; 21, *Fruhstorferiola tonkinensis* Willemse 1922; 22, *Parascopas obesus* (Giglio-Tos 1894).

PLATE 36

Epiphalli of the group Podismae: 1, *Meridacris diabolica* Roberts 1937; 2, *Nitacris goganzenensis* Tinkham 1936; 3, *Conalcaea humphreysii* (Thomas 1875); 4, *Agroecotettix modestus* Bruner 1908; 5, *Chlorus bolivianus* Bruner 1913; 6, *Aeoloplus turnbulli* (Thomas 1872); 7, *Atrachelacris unicolor* Giglio-Tos 1894; 8, *Aidemona azteca* (Saussure 1861); 9, *Hypochlora alba* (Dodge 1876); 10, *Hesperotettix viridis* (Thomas 1872); 11, *Eotettix signatus* Scudder 1898; 12, *Netrosoma nigropleura* Scudder 1898; 13, *Gymnoscirtetis pusillus* Scudder 1898; 14, *Sinaloa pulchella* Hebard 1925; 15, *Halmenus robustus cuspidatus* Snodgrass 1902; 16, *Scotussa rubripes* Bruner 1906; 17, *Chibchacris furcata* Hebard 1923; 18, *Phaedrotettix dumicola dumicola* (Scudder 1879); 19, *Phaulotettix compressus* Scudder 1908; 20, *Dactylotum pictum* (Thomas 1870); 21, *Pedies variabilis* (Scudder 1897); 22, *Bradynotes obesa* (Thomas 1872); 23, *Phoetaliotes nebrascensis* (Thomas 1872); 24, *Paraidemona punctata* (Stål 1878).

PLATE 37

Epiphalli of the group Dericorythi: 1, *Dericorys tibialis* (Pallas 1773). Group Apobolei: 2, *Apoboleus degener* Karsch 1891; 3, *Coenona brevipedalis* Karsch 1896. Group Serpusiae: 4, *Arescutia subnuda* Karsch 1896; 5, *Pseudophialosphaera tectifera* (Ramme 1929); 6, *Auloserpusia schoutedeni* Ramme 1929; 7, *Serpusia succursor* (Karsch 1896). Group Conophymae: 8, *Plotnikovia lanigera* Umnov 1930; 9, *Conophyma jacobsoni* Uvarov 1925; 10, *Dinaria mirzayani* Popov 1951; 11, *Conophyma semenovi* Zubovsky 1898; 12, *Conophyma sokolovi* Zubovsky 1899; 13, *Arminda brunneri* Krauss 1892; 14, *Sphenophyma rugulosu* (Stål 1876). Group Oxyrrhepes: 15, *Afroxyrrhepes procera* (Burmeister 1838); 16, *Homoxyrrhepes punctipennis* (Walker 1870); 17, *Chloroxyrrhepes virescens* (Stål 1873); 18, *Tristria lacerta* Stål 1873; 19, *Anoxyrrhepes prosternalis* (Karny 1907). Group Tropidopola: 20, *Tinnevellia andrewi* Henry 1940; 21, *Tropidopola cylindrica* (Marshall 1835); 22, *Calamippa prasina* (I. Bolivar 1902); 23, *Mesopsilla roseoviridis* Ramme 1929; 24, *Bambusacris greeni* Henry 1933.

PLATE 38

Epiphalli of the group Oxyae: 1, *Oxya hyla* Serville 1831; 2, *Quilta orizae* Uvarov 1925; 3, *Gesonula sanguinolenta* (Krauss 1902); 4, *Ochlandriphaga xanthelytrana* Henry 1933; 5, *Lucretilis jucunda* Miller 1953; 6, *Austeniella cylindrica* (Ramme 1929); 7, *Chitaura mirabilis* (Carl 1916); 8, *Badistica bellula* Karsch 1891; 9, *Caryanda spuria* (Stål 1860); 10, *Dapperia bermoides* Sjostedt 1921; 11, *Racilia aurora* Brunner v. Wattenwyl 1893; 12, *Caledonia fuscovittata* Willemse 1923; 13, *Dibastica major* I. Bolivar 1908; 14, *Cercina obtusa* Stål 1878; 15, *Pterotiltus inuncatus* (Karsch 1892); 16, *Genditia versicolor* (Ramme 1929).

PLATE 39

Epiphalli of the group Leptismae: 1, *Opsomala vitreipennis* (Marschall 1835); 2, *Stenacris cylindroides* (Stål 1860); 3, *Leptisma marginicollis* (Serville 1839); 4, *Heniola frenata* (Marschall 1835); 5, *Oxyblepta bohlsii* (Giglio-Tos 1895); 6, *Oxybleptella sagitta* Giglio-Tos 1894; 7, *Cornops longicorne* (Bruner 1912); 8, *Mastusia spectabilis* I. Bolivar 1890; 9,

Tetrataenia surinama (Linné 1764); 10, *Inusia bicolor* Bruner 1908; 11, *Paracornops longipennis* (De Geer 1773). Group Coptacrae: 12, *Coptacra ensifera* I. Bolivar 1902; 13, *Paracoptacra cauta* Karsch 1896; 14, *Eucoptacra praemorsa* (Stål 1860); 15, *Epistaurus bolivari* Karny 1907; 16, *Parepistaurus stigmaticus* I. Bolivar 1912; 17, *Cyphocerastis tristis* Karsch 1891; 18, *Poecilocerastis striata* Ramme 1929; 19, *Bocagella lanuginosa* I. Bolivar 1889; 20, *Apalacris varicornis* Walker 1870; 21, *Ruvensoracris fasciata* Ramme 1929; 22, *Dubitacris robustus* Henry 1938; 23, *Opharicus ballardi* (I. Bolivar 1917); 24, *Traulia azureipennis* (Serville 1839); 25, *Exochoderes aurantiacus* I. Bolivar 1881.

PLATE 40

Epiphalli of the group Eyprepocnemis: 1, *Phyllocercus bicoloripes* Uvarov 1941; 2, *Heteracris calliptamoides* Uvarov 1921; 3, *Tropidiopsis pendulus* (Karsch 1896); 4, *Thisoicetrellus recurvus* Uvarov 1921; 5, *Cataloipus oberthuri* (I. Bolivar 1891); 6, *Navasia insularis* Kirby 1914; 7, *Macrocara picta* Sjöstedt 1920; 8, *Jucundacris pictipes* (Walker 1870); 9, *Eyprepocnemis plorans* (Charpentier 1825); 10, *Eupreponotus inflatus* Uvarov 1921; 11, *Taramassus cunctator* (Karsch 1900); 12, *Amphiprosopia adjuncta* (Walker 1870); 13, *Parathisoicetrus aethiopicus* Ramme 1929; 14, *Cyathosternum prehensile* (I. Bolivar 1881); 15, *Eumacrotona australis* (Walker 1870); 16, *Choroedocus insignis* (Walker 1870); 17, *Tylostropidius speciosus* (Walker 1870); 18, *Thisoicetrus littoralis* (Rambur 1838); 19, *Paraeprepocnemis syriaca* (Brunner 1861); 20, *Cyclopternacris morbosa* (Serville 1839); 21, *Thisoicetrinus pterostichus* (Fischer v. Waldheim 1846); 22, *Neritius abyssinicus* Uvarov 1934; 23, *Eyprepocnemides pictipes* (I. Bolivar 1902); 24, *Oxyaidea poultoni* Ramme 1929; 25, *Asmara glabra* Uvarov 1938.

PLATE 41

Epiphalli of the ungrouped genera of Catantopinae: 1, *Mesambria dubia* (Walker 1870); 2, *Palniacris maculatus* Henry 1940; 3, *Urugalla pearsoni* Uvarov 1927; 4, *Acaeropa indica* (I. Bolivar 1884); 5, *Genimen prasinum* I. Bolivar 1917; 6, *Paraconophyma scabra* (Walker 1870); 7, *Poecilochroma bolivari* Willemse 1932; 8, *Nisioicantopos orientalis* (Kirby 1888); 9, *Sedulia specularia* (Stål 1875); 10, *Siruvania dimorpha* Henry 1940; 11, *Bibracte sumatrana* Willemse 1930; 12, *Phalaca saravakensis* Willemse 1938; 13, *Conophymacris chinensis* Willemse 1933; 14, *Traulidia antennata* Miller 1934; 15, *Enoplotettix gardineri* (I. Bolivar 1912); 16, *Naraikadua carmichaelae* Henry 1940; 17, *Gerenia abbreviata* Brunner-Wattenwyl 1893; 18, *Genimenoides subapterum* (Uvarov 1927); 19, *Anacranae nuda* Miller 1934; 20, *Utanaecris pulchra* Miller 1934; 21, *Euthymia fasciata* (Walker 1870); 22, *Iranella eremiaphila* Uvarov 1922; 23, *Opiptacris hilaris* Walker 1870; 24, *Pileolum kirbyi* I. Bolivar 1917; 25, *Jinabia thesigeri* Uvarov 1952; 26, *Bufoacridella sumakovi* Adelung 1910.

PLATE 42

Epiphalli of the ungrouped genera of Catantopinae: 1, *Macrolobalia ocellata* Tepper 1896; 2, *Goniaea maculicornis* Stål 1878; 3, *Cervidia lobipes* Stål 1878; 4, *Pacurria striata* Sjöstedt 1921; 5, *Coryphistes ruricola* (Burmeister 1838); 6, *Beplessia rubrotuberculata* Sjöstedt 1921; 7, *Adreppus microconspersus* Sjöstedt 1921; 8, *Euophistes variegatus* Sjöstedt 1920; 9, *Caderia limbata* Sjöstedt 1920; 10, *Erythropomala amaena* (Walker 1870); 11, *Pardillana limbata* (Stål 1878); 12, *Xiphiola borellii* Giglio-Tos 1900; 13, *Syntomacris vittipennis* Walker 1870; 14, *Caletes apterus* Redtenbacher 1892; 15, *Vilerna aeneo-oculata* (De Geer 1773); 16, *Aptoceras margaritatus* Bruner 1908; 17, *Locheuma brunneri* (Scudder 1875); 18, *Psiloscirtus bolivianus* (Brunner 1913); 19, *Rhytidochrota polia* Hebard 1923; 20, *Agesander ruficornis* Stål 1878; 21, *Leptomerinthophora modesta* Bruner 1908; 22, *Ommatolampis perspicillata* (Johanssen 1763); 23, *Hylopedetes mirandus* Rehn 1929; 24, *Opaonella tenuis* Hebard 1923; 25, *Sitacles trinitatis* Bruner 1906; 26, *Rhachicreagra gracilis* Bruner 1908.

PLATE 43

Epiphalli of the ungrouped genera of Catantopinae: 1, *Parazelum rubripes* Sjöstedt 1921; 2, *Macrolopholia longipennis* Sjöstedt 1920; 3, *Peakesia nana* Sjöstedt 1921; 4,

Stropis maculosa (Stål 1860); 5, *Cedarinia costata* Sjöstedt 1921; 6, *Diexis varentzovi* Zubowsky 1898; 7, *Izalidium usambaricum* Ramme 1929; 8, *Segellia lepida* Karsch 1893; 9, *Leioetettix viridis* Bruner 1906; 10, *Abracris nebulosa* (Bruner 1900); 11, *Trigonophymus bergii* (Stål 1878); 12, *Osmilia flavolineata* (De Geer 1773); 13, *Perbellia picta* Sjöstedt 1920; 14, *Apotropis exclusa* (Walker 1870); 15, *Terpillaria callopus* Sjöstedt 1921; 16, *Desertaria lepida* (Walker 1870); 17, *Ischnansis curvicerca* Uvarov 1938; 18, *Allotriusia luteipennis* Ramme 1929; 19, *Pteroperina steini* (Rehn 1914); 20, *Pteropera carnapi* Ramme 1929; 21, *Gemeneta terrea* Karsch 1892; 22, *Burtia sylvatica* Dirsh 1951; 23, *Eurynotacris somalica* Ramme 1931; 24, *Pezotettix giornae* (Rossi 1794); 25, *Carydana agomena* Karsch 1896; 26, *Frontifissia elegans* Key 1937; 27, *Allaga lacerta* (Burr 1900).

PLATE 44

Epiphalli of the ungrouped genera of Catantopinae: 1, *Phanocerus testudo* Saussure 1888; 2, *Phaeoparia carrikeri* Hebard 1923; 3, *Macrazelota cervina* (Walker 1870); 4, *Tolgadia brachyptera* Sjöstedt 1920; 5, *Praxibulus laminatus* (Stål 1878); 6, *Brachaspis nivalis* (Hutton 1898); 7, *Urnisia guttolosa* (Walker 1870); 8, *Exarna includens* (Walker 1870); 9, *Cirphula pyrrhonemis* (Stål 1860); 10, *Buforania crassa* Sjöstedt 1920; 11, *Pododula ancisa* Karsch 1896; 12, *Abisares viridipennis* (Burmeister 1838); 13, *Adimantus ornatissimus* (Burmeister 1838); 14, *Anniceris meridionalis* Bruner 1908; 15, *Phaulacridium gemini* (Sjöstedt 1920); 16, *Diponthus paraguayensis* Bruner 1906; 17, *Conometopus sulcatifolius* (Blanchard 1851); 18, *Proctolabus gracilis* Bruner 1908; 19, *Coscineuta virens* (Thunberg 1815); 20, *Nahuelia rubriventris* Lieberman 1942; 21, *Aptenopedes sphenarioides* Scudder 1877; 22, *Taeniophora dentipes* Stål 1873; 23, *Microtylopteryx talamancae* Rehn 1929. Genera of uncertain position: 24, *Hepalicus gracilis* Sjöstedt 1921; 25, *Bactrophora dominans* Westwood 1842; 26, *Philippiacris* sp.; 27, *Anamesacris abajoi* Morales 1949; 28, *Lithoscirtus miniatula* (Rehn 1905); 29, *Aucacris eumera* Hebard 1929; 30, *Bufonacris terrestris* Walker 1871.

PLATE 45

Epiphalli of the subfamily Calliptaminae: 1, *Calliptamus italicus* (Linné 1758); 2, *Metromerus colesyriensis* (Giglio-Tos 1893); 3, *Peripolus pedarius* (Stål 1878); 4, *Indomerus noxius* Dirsh 1951; 5, *Stobbea riggenbachii* Ramme 1929; 6, *Bothrocaracris bolivari* Uvarov 1950; 7, *Sphodronotus cyclopterus* (Uvarov 1933); 8, *Sphodromerus tuareg* Uvarov 1943; 9, *Brachyzenia scutifera* (Walker 1870); 10, *Caloptenopsis glaucoptis meruensis* (Sjöstedt 1909); 11, *Paracaloptenus caloptenoides* (Brunner v. Wattenwyl 1861); 12, *Acorypha picta* Krauss 1877.

PLATE 46

Epiphalli of the subfamily Euryphyminae: 1, *Acrophymus cuspidatus* (Karsch 1900); 2, *Phymeurus stolidus* (I. Bolivar 1889); 3, *Euryphymus haematopus* (Linné 1758); 4, *Aneurypymus erythropus* (Thunberg 1815); 5, *Anabibia thoracica* Dirsh 1956; 6, *Brachypymus vylderii* (Stål 1876); 7, *Calliptamicus semiroseus* (Serville 1838); 8, *Plegmapteropsis gracilis* Dirsh 1956; 9, *Amblyphymus miniatus* Uvarov 1922; 10, *Platacanthoides bituberculatus* Uvarov 1922; 11, *Martinezius fernandezi* Uvarov 1922; 12, *Calliptamulus sulphureus* Uvarov 1922; 13, *Rhachitopis curvipes* (Stål 1876); 14, *Calliptamuloides minimus* Dirsh 1956.

PLATE 47

Phallic complex of *Hemiacris fervens* Walk.: A, whole complex, dorsal view; B, C, phallic organ, epiphallus and part of ectophallic membrane removed, dorsal and ventral views; D, E, phallic organ, zygoma and apodemes removed, dorsal and ventral views; F, phallic organ (corresponding to Figs. B and C), epiphallus and ectophallic membrane removed, lateral view; G, H, endophallus with arch and valves of cingulum, dorsal and ventral views; I, phallic organ, zygoma and apodemes removed, lateral view; J, K, penis, dorsal and ventral views; L, endophallus, lateral view (corresponding to Figs G, and H); M, penis, lateral view; N, endophallic sacs in profile, diagrammatic.

PLATE 48

Phallic complex of *Tarbaleus cingalensis* Kirby : A, B, whole complex, dorsal and ventral views ; C, D, E, phallic organ, lateral, dorsal and ventral views, epiphallus and ectophallic membrane removed ; F, G, H, phallic organ, lateral, dorsal and ventral views, zygoma and apodemes removed ; I, J, K, phallic organ, lateral, dorsal and ventral views, zygoma, apodemes and rami removed ; L, M, N, penis, lateral, dorsal and ventral views ; O, endophallic sacs in profile, diagrammatic.

PLATE 49

Epiphalli of the subfamily Hemiacridinae : 1, *Pristocorypha latruncularia* Karsch 1896 ; 2, *Hemipristocorypha mayidica* Dirsh 1952 ; 3, *Phalinus uvarovi* (Ramme 1929) ; 4, *Clonacris kirbyi* (Finot 1903) ; 5, *Hemiacris fervens* Walker 1870 ; 6, *Malagasacris strateia* Rehn 1944 ; 7, *Pareuthymia fusca* Willemse 1930 ; 8, *Lopheuthymia brunneri* (Finot 1903) ; 9, *Oraistes luridus* Karsch 1896 ; 10, *Hieroglyphus daganensis* Krauss 1877 ; 11, *Ischnacrida vittata* (Fabricius 1787) ; 12, *Meruana usambarica* (Karsch 1896) ; 13, *Acanthoxia gladiator* (Westwood 1841) ; 14, *Gonyacanthella lanceolata* (I. Bolivar 1890) ; 15, *Tarbaleus gammaduensis* Henry 1933 ; 16, *Castesia dispar* I. Bolivar 1901 ; 17, *Metapa pretoriae* Miller 1932 ; 18, *Mesopsera filum* (I. Bolivar 1890).

PLATE 50

Epiphalli of the subfamily Hemiacridinae : 1, *Rhamphacrida kraussi* (I. Bolivar 1890) ; 2, *Paratraulia karnyi* Willemse 1925 ; 3, *Xenippa viridula* Stål 1878 ; 4, *Spathosternum nigrotaeniatum* (Stål 1876) ; 5, *Kassongia flavovittata* I. Bolivar 1908 ; 6, *Calviniacris nuda* Dirsh 1956 ; 7, *Zygoclistron trachystictum* Rehn 1905 ; 8, *Aleuas gracilis* Stål 1878 ; 9, *Perakia striatipennis* Ramme 1930 ; 10, *Sudanacris pallida* (Burmeister 1838) ; 11, *Bermius brachycerus* Stål 1878 ; 12, *Willemseella bicolor* Miller 1934 ; 13, *Pseudocarsula tarsalis* (Walker 1870) ; 14, *Loryma perficita* (Walker 1870) ; 15, *Paraspathosternum pedestris* Miller 1928 ; 16, *Glauningia macrocephala* Ramme 1929 ; 17, *Parahieroglyphus bilineatus* I. (Bolivar 1912) ; 18, *Leptacris violacea* (Karny 1907).

PLATE 51

Phallic complex of *Acrida turrita* (L.) : A, B, whole complex, dorsal and ventral views ; C, D, E, phallic organ, lateral, dorsal and ventral views, epiphallus and ectophallic membrane removed ; F, G, H, phallic organ, lateral, dorsal and ventral views, zygoma, apodemes and rami removed ; I, J, K, penis lateral, dorsal and ventral views ; L, endophallic sacs in profile, diagrammatic.

PLATE 52

Epiphalli of the subfamily Acridinae. Group Pargi : 1, *Acteana alazonica* Karsch 1896 ; 2, *Amphicremna tschoffeni* I. Bolivar 1908 ; 3, *Machaeridia bilineata* Stål 1873 ; 4, *Paraparga brevipennis* Uvarov 1922 ; 5, *Parga cyanoptera* Uvarov 1926 ; 6, *Wilverthia acuminata* I. Bolivar 1908. Group Acridae : 7, *Malcolmburria angolensis* Uvarov 1953 ; 8, *Julea indica* I. Bolivar 1914 ; 9, *Roduniella insipida* (Karsch 1896) ; 10, *Zacompsa festa* Karsch 1893 ; 11, *Paracomacris stenopterus* (Schaum 1853) ; 12, *Chirista compta* (Walker 1870) ; 13, *Comacris semicarinatus* (Gerstaecker 1869) ; 14, *Gymnobothroides pullus* Karny 1915 ; 15, *Gymnobothrus linea-alba* I. Bolivar 1889 ; 16, *Oxybothrus punctifrons* Uvarov 1953 ; 17, *Cryptiobothrus chrysophorus* Rehn 1907 ; 18, *Cumarala annexens* Hebard 1923 ; 19, *Dichroaettix bohlsii* (Giglio-Tos 1895) ; 20, *Eutryxalis gracilis* (Giglio-Tos 1897) ; 21, *Hyalopteryx specularis* Bruner 1906 ; 22, *Melanotettix dibelonus* Bruner 1904 ; 23, *Metaleptea brevicornis* (Linné 1764) ; 24, *Parachleobata scudderi* (I. Bolivar 1888) ; 25, *Paratruxalis filatus* (Walker 1870) ; 26, *Parorphula graminea* Bruner 1900 ; 27, *Rhadinotatum minimipenne* (Caudell 1904) ; 28, *Thyriptilon vitripennis* Bruner 1904.

PLATE 53

Epiphalli of the group Acridae : 1, *Carliola carinata* Uvarov 1929 ; 2, *Odontomelus usambaricus* Ramme 1929 ; 3, *Machaerocera tibialis* (Walker 1870) ; 4, *Acrida turrita*

(Linné 1758); 5, *Phlaeoba antennata* Brunner-Wattenwyl 1893; 6, *Chokwea burri* Uvarov 1953; 7, *Glyphoclonus miripennis* Karsch 1896; 8, *Culmulus stramineus* Uvarov 1953; 9, *Cannula linearis* (Saussure 1861); 10, *Pasiphimus sagittae-formis* I. Bolivar 1914; 11, *Oxyurga parabolica* Uvarov 1953; 12, *Gonista bicolor* (De Haan 1842); 13, *Schizobothrus flavovittatus* Sjöstedt 1921; 14, *Gelastorhinus sinensis* (Walker 1871); 15, *Rhabdoplea munda* Karsch 1893; 16, *Chromacrida brunneriana* (I. Bolivar 1893); 17, *Paralobopoma gracilis* (Ramme 1929); 18, *Keya capicola* Uvarov 1941; 19, *Duroniella laticornis* (Krauss 1909).

PLATE 54

Epiphalli of the group Acridae: 1, *Duronia tricolor* (Karny 1907); 2, *Euprepoptera polychroma* Uvarov 1953; 3, *Perella insignis* I. Bolivar 1914; 4, *Orthochtha dasyncnemis* (Gerstaecker 1869); 5, *Duroniopsis bitaeniata* I. Bolivar 1914; 6, *Ceracris nigricornis* Walker 1870; 7, *Pyrgophlaeoba pendleburyi* Miller 1929; 8, *Rasperecta bisulcata* (Krauss 1877); 9, *Sherifuria haningtoni* Uvarov 1926; 10, *Weenenia thomasseti* Miller 1932; 11, *Pamacris diversipennis* Ramme 1929; 12, *Lobopoma ambages* Karsch 1896; 13, *Bababuddinia bizonata* I. Bolivar 1917; 14, *Macrocyomochta speciosa* Sjöstedt 1931; 15, *Hyperocnoceris sulcatis* (Karsch 1893); 16, *Sikkimiana darjeelingensis* (I. Bolivar 1914); 17, *Wellawaya greeni* Uvarov 1927; 18, *Zygophlaeoba sinuaticollis* I. Bolivar 1902; 19, *Pseudophlaeoba henryi* I. Bolivar 1914; 20, *Xerophlaeoba deserticola* (Krauss 1902); 21, *Holopercna gerstaeckerii* (I. Bolivar 1890); 22, *Sumba roseipennis* I. Bolivar 1912; 23, *Ocnoceris diabolicus* Karsch 1893; 24, *Paraphlaeoba platyceps* I. Bolivar 1902; 25, *Paraduronia carinata* (I. Bolivar 1902); 26, *Phlaeobida angustipennis* I. Bolivar 1902.

PLATE 55

Phallic complex of *Oedipoda caerulescens* (L.): A, B, whole complex, dorsal and ventral views; C, phallic organ, lateral view, epiphallus and part of ectophallic membrane removed; D, E, F, phallic organ, dorsal, ventral and lateral views, epiphallus and ectophallic membrane removed; G, H, I, phallic organ, dorsal ventral and lateral views, zygoma, apodemes and rami removed; J, K, L, penis lateral, dorsal and ventral views; M, endophallic sacs in profile, diagrammatic.

PLATE 56

Epiphalli of the group Oedipodae: 1, *Compsorhipis darvidiana* (Saussure 1888); 2, *Hadrotettix trifasciatus* (Say 1825); 3, *Pseudocoles ebneri* Dirsh 1949; 4, *Thalpomena algeriana* (Lucas 1849); 5, *Somalella thalpolenoides* Dirsh 1949; 6, *Crinita hirtipes* (Uvarov 1923); 7, *Cophotylus aurora* (Karny 1907); 8, *Chondronotulus bengalensis* (Saussure 1888); 9, *Wernerella* sp.; 10, *Vosseleriana somali* (Uvarov 1923); 11, *Hyalorrhapis clausi* (Kittary 1849); 12, *Leptopternis gracilis* (Eversman 1848); 13, *Phaeonotus pulcher* Popov 1951; 14, *Helioscirtus moseri* Saussure 1884; 15, *Sphingonotus caerulans* (Linné 1767); 16, *Heliopteryx humeralis* (Kuthy 1907); 17, *Pusana laevis* (Uvarov 1921); 18, *Pternoscirta cinctifemur* (Walker 1859); 19, *Acrotylus insubricus* (Scopoli 1786); 20, *Qualetta maculata* Sjöstedt 1921; 21, *Pycnostictus seriatus* Saussure 1884; 22, *Anconia integra* Scudder 1876; 23, *Coniana snowi* Caudell 1915; 24, *Heliastus sumichrasti* (Saussure 1861); 25, *Cibolacris parviceps* (Walker 1870); 26, *Aerochoreutes carlinianus* (Thomas 1870).

PLATE 57

Epiphalli of the group Oedipodae: 1, *Dissosteira carolina* (Linné 1758); 2, *Scirtetica marmorata* (Harris 1841); 3, *Spharagemon aequale* (Say 1825); 4, *Microtes nubila* Scudder 1900; 5, *Lactista gibbosa* Saussure 1884; 6, *Tomonotus mexicanus* Saussure 1861; 7, *Leuronotina orizabae* (Saussure 1884); 8, *Platylactista aztecus* (Saussure 1861); 9, *Morphacris sanguinea* (Thunberg 1815); 10, *Oedipoda caerulescens* (Linné 1758); 11, *Pietica cristulata* Saussure 1884; 12, *Mioscirtus wagneri* (Eversman 1859); 13, *Psinidia fenestralis* (Serville 1838); 14, *Metator pardalinus* (Saussure 1884); 15, *Trachyrhachys aspera* Scudder 1876; 16, *Trepidulus pulchella* (Bruner 1889); 17, *Conozoa wallula* (Scudder 1880); 18, *Derotmema haydeni* (Thomas 1871); 19, *Trilophidia repleta* (Walker 1870); 20, *Tmetonota dispar*

Miller 1928; 21, *Pseudotrimerotropis monticola* (Saussure 1884); 22, *Trimerotropis bilobata* Rehn and Hebard 1906; 23, *Circotettix undulatus* (Thomas 1871); 24, *Bryodema tuberculata* (Fabricius 1775); 25, *Angaracris barabensis* (Pallas 1771).

PLATE 58

Epiphalli of the group Oedipodae: 1, *Celes variabilis* (Pallas 1771); 2, *Oedaleus decorus* (Germar 1826); 3, *Gastrimargus africanus* (Saussure 1888); 4, *Heteropternis respondens* (Walker 1859); 5, *Locusta migratoria* (Linné 1758); 6, *Locustana paradalina* (Walker 1870); 7, *Hippiscus rugosus* (Scudder 1862); 8, *Pardalophora tuberculata* (Palisot de Beauvois 1805); 9, *Xanthippus corallipes* (Haldeman 1852); 10, *Leprus glaucipennis* Scudder 1900; 11, *Agyrnastus ingens* (Scudder 1877); 12, *Psophus stridulus* (Linné 1758); 13, *Pyrgodera armata* (Fischer v. Waldheim 1820); 14, *Tropidolophus formosus* (Say 1825); 15, *Brunerella mirabilis* Saussure 1889; 16, *Humbe tenuicornis* (Schaum 1853); 17, *Pycnodicta galinieri* (Reiche and Fairmaire 1847); 18, *Pycnocrania grandidieri* (Saussure 1888); 19, *Chloebora crassa* (Walker 1870); 20, *Consistica saucia* (Stål 1873); 21, *Scintharista notabilis* (Walker 1870); 22, *Arphia xanoptera* (Burmeister 1838).

PLATE 59

Epiphalli of the group Oedipodae: 1, *Chortoicetes terminifera* (Walker 1870); 2, *Caledia captiva* (Fabricius 1775); 3, *Paracinema tricolor* (Thunberg 1815); 4, *Uganda kilimandjarica* (Sjostedt 1909); 5, *Jasomenia cinctipes* Miller 1932; 6, *Chimarocephala pacifica* (Thomas 1873); 7, *Rapsilla fusca* Sjostedt 1921; 8, *Encoptolophus texensis* Bruner 1905; 9, *Mecostethus grossus* (Linné 1758); 10, *Aiolopus thalassinus* (Fabricius 1781); 11, *Hilethera aeolopoides* (Uvarov 1922); 12, *Aulocaroides leroii* Werner 1913; 13, *Lerinnia oedipodioides* (I. Bolivar 1902); 14, *Austroicetes frater* (Brancsik 1897); 15, *Froggattia australis* (Walker 1870); 16, *Anaeolopus socius* (Stål 1861); 17, *Camnula pellucida* (Scudder 1862); 18, *Homoeopternis crassiceps* Uvarov 1953; 19, *Dittoternis turbata* (Walker 1870); 20, *Pternoscirtus gracilis* (Miller 1929); 21, *Parapleurus alliaceus* (Germar 1817); 22, *Chortophaga viridifasciata* (De Geer 1773); 23, *Calephorus compressicornis* (Latreille 1804).

PLATE 60

Epiphalli of the subfamily Egnatiinae: 1, *Charora crassivenosa* Saussure 1888; 2, *Egnatius apicalis* (Stål 1876); 3, *Egnatiella cabrerai* I. Bolivar 1914; 4, *Egnatioides striatus* Vosseler 1902; 5, *Leptoscirtus isphahanicus* Uvarov 1933. Subfamily Eremogryllinae: 6, *Notopleura saharica* Krauss 1902; 7, *Eremogryllus hammadae* Krauss 1902. Subfamily Truxalinae: 8, *Truxalis nasutus* (Linné 1758); 9, *Chromotruxalis cockerelli* (Uvarov 1932); 10, *Quangula minuta* Uvarov 1953; 11, *Truxaloides serratus* (Thunberg 1815); 12, *Phonogaster cariniventris* Henry 1940; 13, *Brachycrotaphus tryxalicerus* (Fischer 1853); 14, *Acridaracknea ophthalmica* I. Bolivar 1908; 15, *Ptygonotus semenovi* Tarbinsky 1927; 16, *Aswathamanus cylindricus* Kirby 1914; 17, *Cophohippus burri* Uvarov 1953; 18, *Goniocara brevipes* Uvarov 1953; 19, *Psectrocnemus longiceps* (I. Bolivar 1902); 20, *Primnia sanctae-helenae* (Stål 1861); 21, *Dhimbama dawsoni* Henry 1940; 22, *Pseudoarcyptera cephalica* (I. Bolivar 1914); 23, *Madurea cephalotes* I. Bolivar 1902; 24, *Afrohippus lei* Uvarov 1941.

PLATE 61

Phallic complex of *Truxalis nasutus* (L.): A, B, whole complex, dorsal and ventral views; C, phallic organ, lateral view, epiphallus and part of ectophallic membrane removed; D, E, phallic organ, dorsal and ventral views, epiphallus and ectophallic membrane removed; F, G, H, endophallus, lateral, dorsal and ventral views; I, J, K, penis, lateral, dorsal and ventral views; L, endophallic sacs in profile, diagrammatic.

PLATE 62

Epiphalli of the subfamily Truxalinae: 1, *Podismopsis altaica* Zubowsky 1900; 2, *Chrysochaeron dispar* (Germar 1835); 3, *Eremippus simplex* (Eversman 1859); 4, *Euthystira*

brachyptera (Ocskay 1826); 5, *Mongolotettix ussuriensis* (Ikonnikov 1911); 6, *Ochrilidia gracilis* (Krauss 1902); 7, *Paragonista infumata* Willemse 1932; 8, *Capulica pulla* I. Bolivar 1917; 9, *Gomphocerus sibiricus* (Linné 1767); 10, *Phlocerus menetriesii* Fischer-Waldheim 1833; 11, *Gomphoceridius brevipennis* (Brisout 1848); 12, *Xerohippus cyprius* Uvarov 1942; 13, *Mesasiippus kozhevnikovi* (Turbinsky 1925); 14, *Myrmeoleottix maculatus* (Thunberg 1815); 15, *Dasyhippus escaleraei* (I. Bolivar 1899); 16, *Gomphocerippus rufus* (Linné 1758); 17, *Aeropedellus variegatus* (Fischer-Waldheim 1846); 18, *Stauroderus scalaris* (Fischer-Waldheim 1846); 19, *Chorthippus albomarginatus* (De Geer 1773); 20, *Euchorthippus pulvinatus* (Fischer-Waldheim 1846); 21, *Luenia burri* Uvarov 1953; 22, *Eleutherotheca fungosa* (I. Bolivar 1889); 23, *Berengueria bifoveolata* (Karsch 1893); 24, *Pseudogmothela stauronotus* (Uvarov 1921).

PLATE 63

Epiphalli of the subfamily Truxalinae: 1, *Platypternodes brevipes* (Stål 1876); 2, *Azarea lloydi* Uvarov 1926; 3, *Thyridota dispar* Uvarov 1925; 4, *Sporobolius darlingi* Uvarov 1941; 5, *Diablepia viridis* Kirby 1902; 6, *Anablepia granulata* (Ramme 1929); 7, *Platypternella cretacea* (I. Bolivar 1914); 8, *Mesopsis gracilicornis* (Krauss 1877); 9, *Rhaphotittha levis* Karsch 1896; 10, *Lava indica* (I. Bolivar 1902); 11, *Bodenheimerella hemiptera* Uvarov 1952; 12, *Stenohippus arabicus* Uvarov 1936; 13, *Omocestus viridulus* (Linné 1758); 14, *Stenobothrus rubicundus* (Germar 1817); 15, *Stenobothrus lineatus* (Panzer 1796); 16, *Aulacobothrus strictus* I. Bolivar 1902; 17, *Paragymnobothrus rufipes* (Uvarov 1925); 18, *Pnorisa squalus* (Stål 1860); 19, *Dociostaurus maroccanus* (Thunberg 1815); 20, *Dociostaurus brevicollis* (Eversmann 1848); 21, *Notostaurus anatolicus* (Krauss 1896); 22, *Arcyptera fusca* (Pallas 1773); 23, *Dnopherula marshalli* Miller 1932; 24, *Ramburiella hispanica* (Rambur 1838); 25, *Kraussella amabile* (Krauss 1877); 26, *Faureia rosea* Uvarov 1921.

PLATE 64

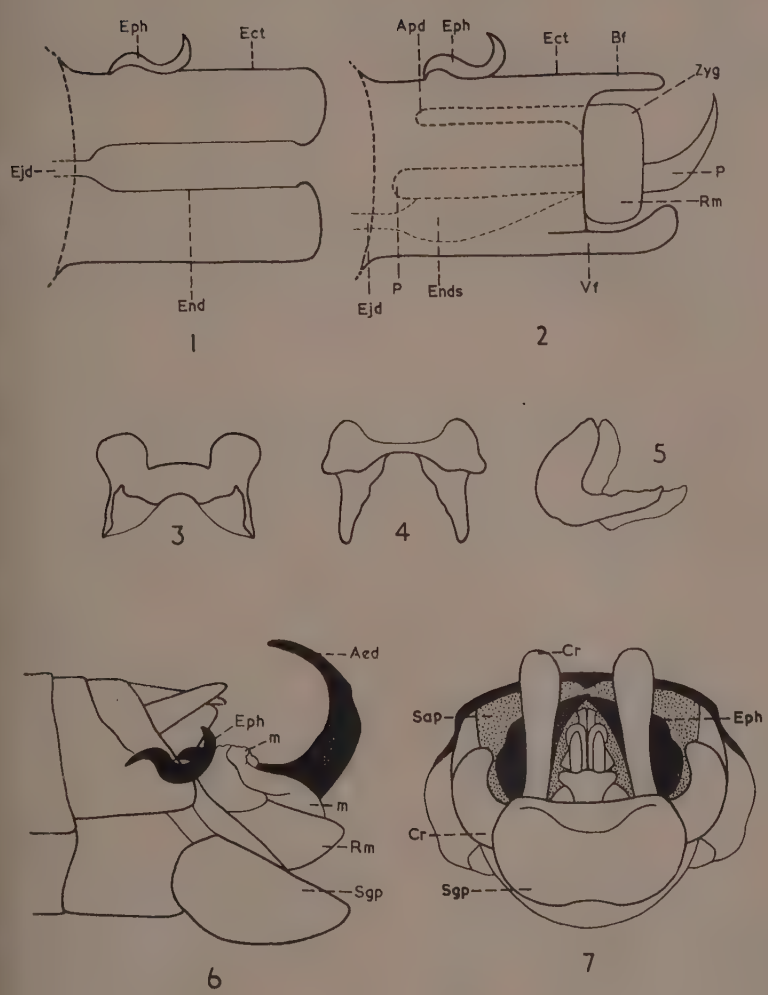
Epiphalli of the subfamily Truxalinae: 1, *Achurum sumichrasti* (Saussure 1861); 2, *Fenestra pulchripennis* Bruner 1900; 3, *Amblytropidia occidentalis* (Saussure 1861); 4, *Eremiacris pallida* (Bruner 1900); 5, *Mesochloa abortiva* (Bruner 1890); 6, *Boottettix punctatus* (Scudder 1890); 7, *Cordillacris apache* Rehn and Hebard 1909; 8, *Compsacris pulcher* I. Bolivar 1890; 9, *Chloealtis conspersa* (Harris 1841); 10, *Paropomala wyomingensis* (Thomas 1871); 11, *Clinocephalus elegans* Morse 1896; 12, *Horesidotes cinereus* Scudder 1899; 13, *Silvitettix communis* Bruner 1904; 14, *Scyllina brasiliensis* (Bruner 1904); 15, *Euplectrotettix ferrugineus* Bruner 1900; 16, *Orphulella pelidna* (Burmeister 1838); 17, *Dichromorpha viridis* (Scudder 1862); 18, *Staurorhectus longicornis* Giglio-Tos 1897; 19, *Pedioscirtetes maculipennis* (Scudder 1890); 20, *Morseiella flaviventris* (Bruner 1904); 21, *Platybothrus brunneus* (Thomas 1871); 22, *Acrolophitus hirtipes* (Say 1825).

PLATE 65

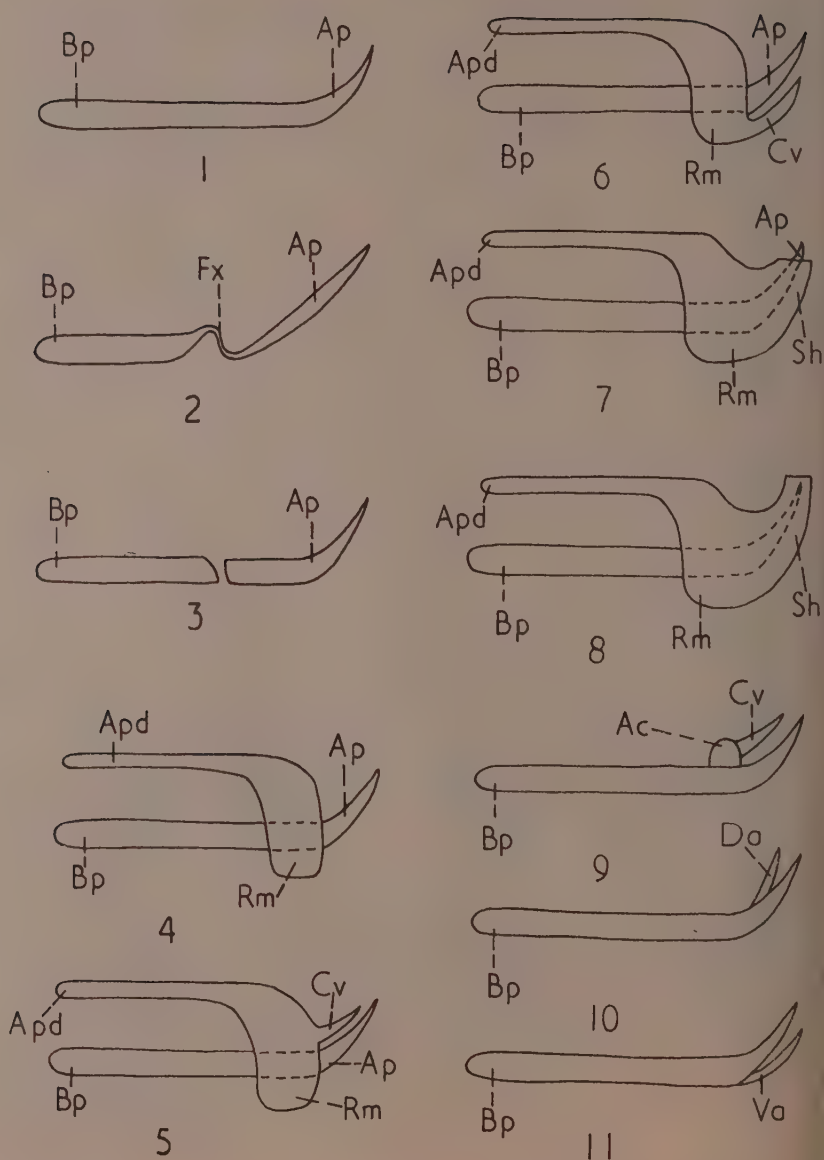
Epiphalli of the subfamily Truxalinae: 1, *Amphitornus bicolor* (Thomas 1872); 2, *Eritettix simplex* (Scudder 1869); 3, *Sinipta dalmani* (Stål 1860); 4, *Macneilia obscura* (Scudder 1877); 5, *Pseudopomala brachyptera* (Scudder 1862); 6, *Napaia gracilis* McNeil 1897; 7, *Heliaula rufa* (Scudder 1899); 8, *Acantherus piperatus* Scudder 1902; 9, *Psoloezza texana* Scudder 1875; 10, *Phlibostroma quadrimaculata* (Thomas 1871); 11, *Zapata saluator* Rehn, 1927; 12, *Stirapleura pusilla* Scudder 1899; 13, *Aulocara elliotti* (Thomas 1870); 14, *Mermiria alacris* Scudder 1877; 15, *Peruvia nigromarginata* (Scudder 1875); 16, *Eupnigodes sierranus* Rehn & Hebard; 17, *Ligurotettix coquilleti* McNeil 1897; 18, *Goniatron planum* Bruner 1905; 19, *Ageneotettix deorum* (Scudder 1870); 20, *Syrbula admirabilis* (Uhler 1864).

PLATE 66

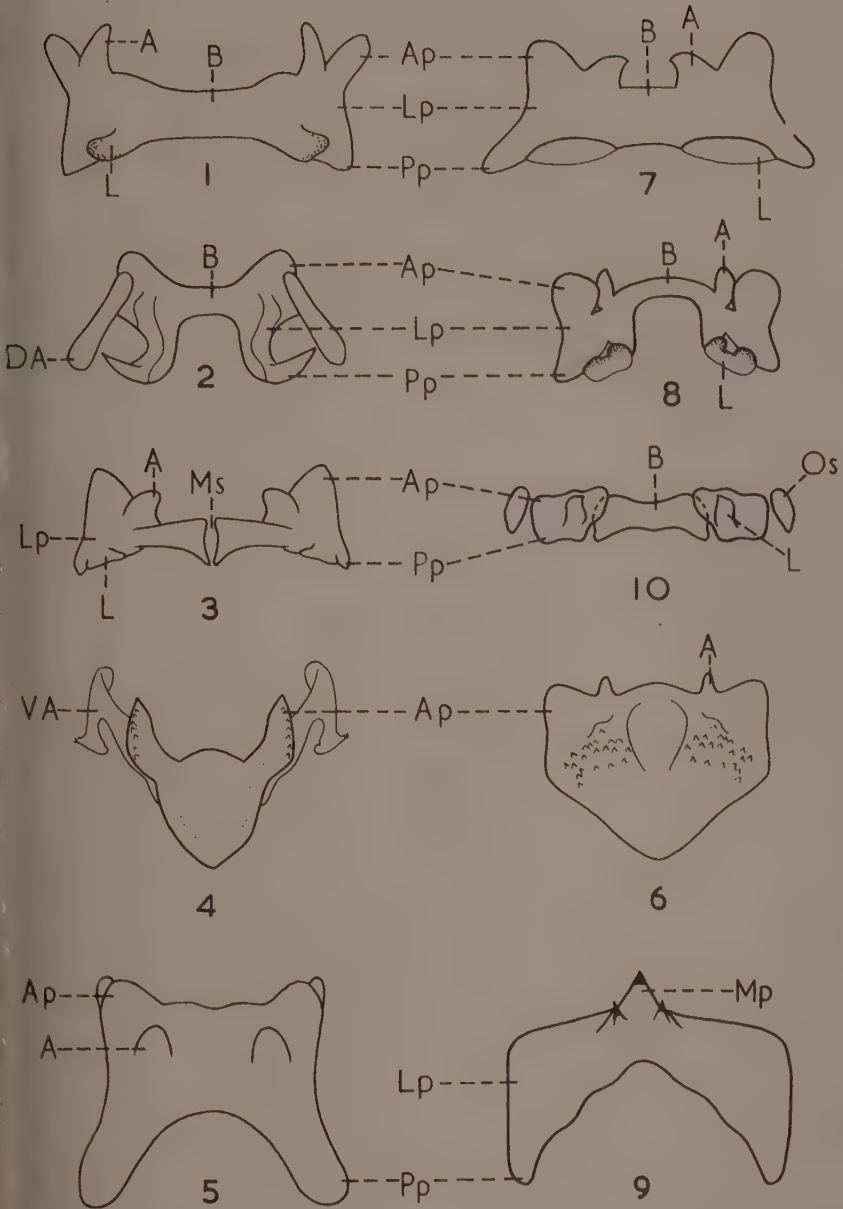
Phylogenetical scheme of Acridoidea.



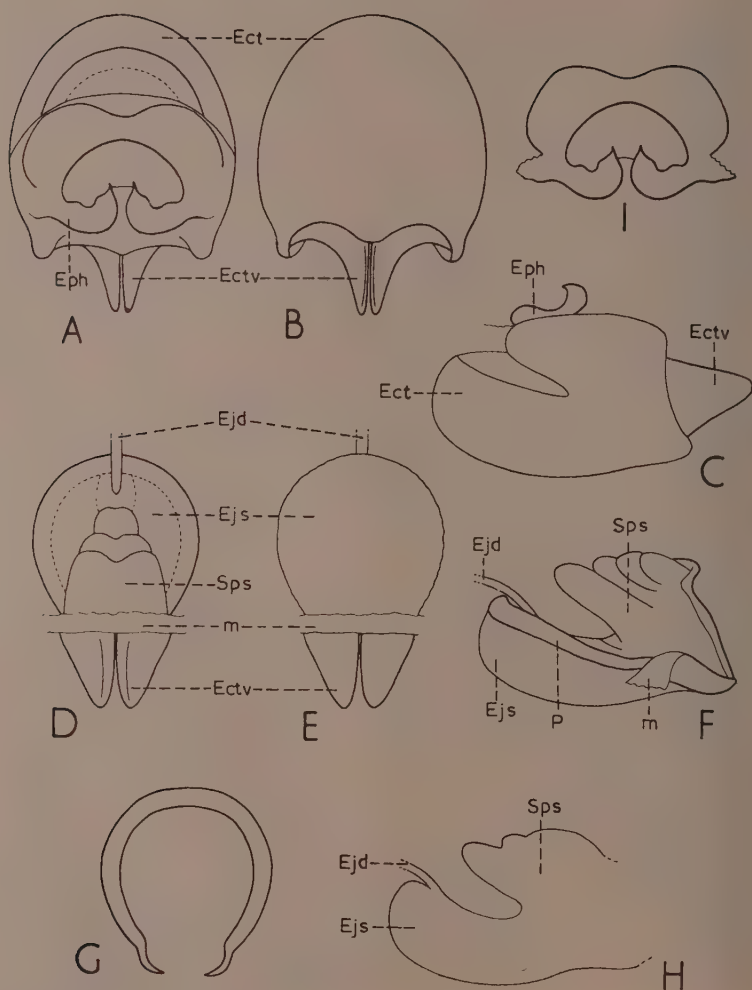
Diagrams of the phallic complex



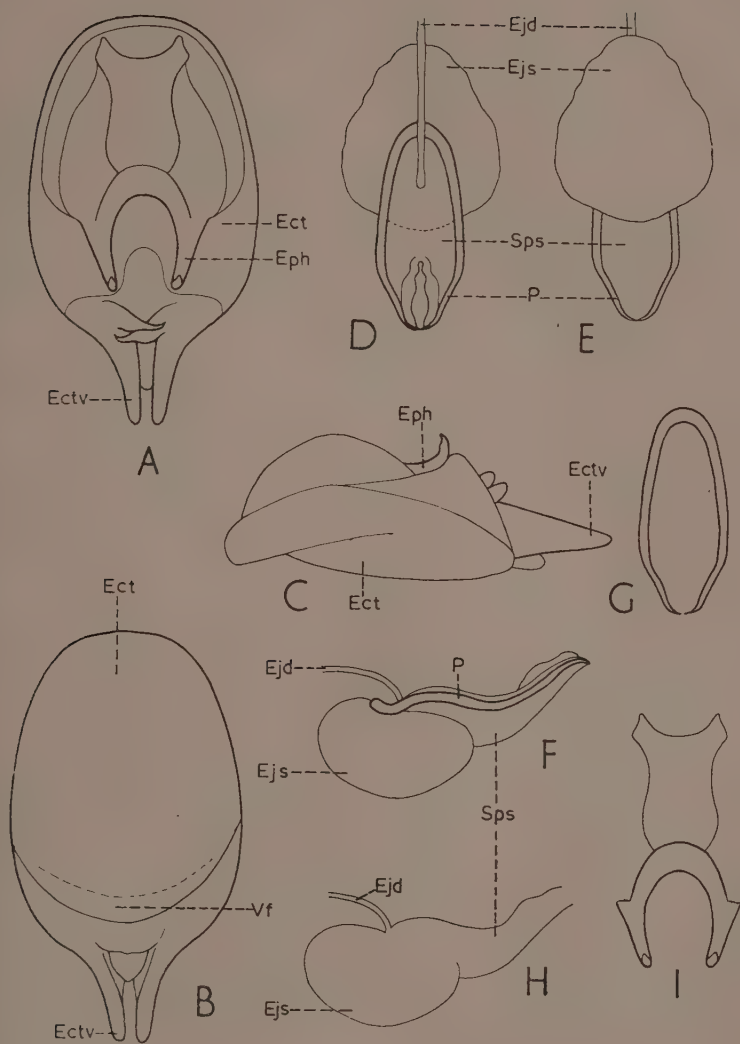
Diagrams of phallus



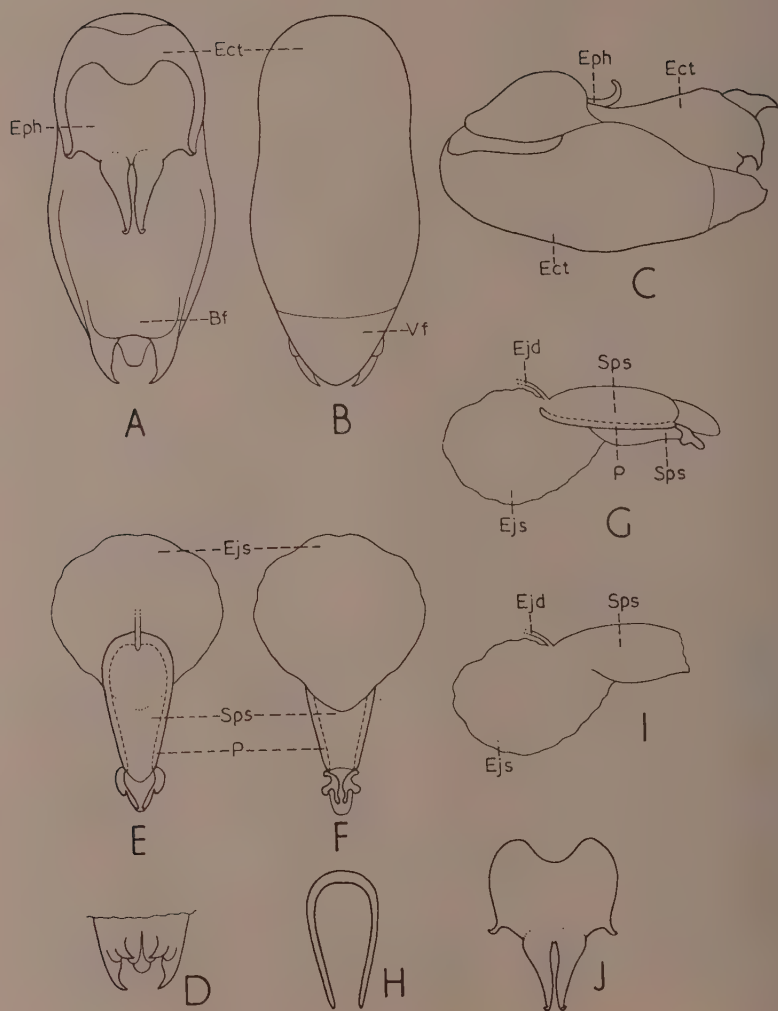
Different types of epiphallus



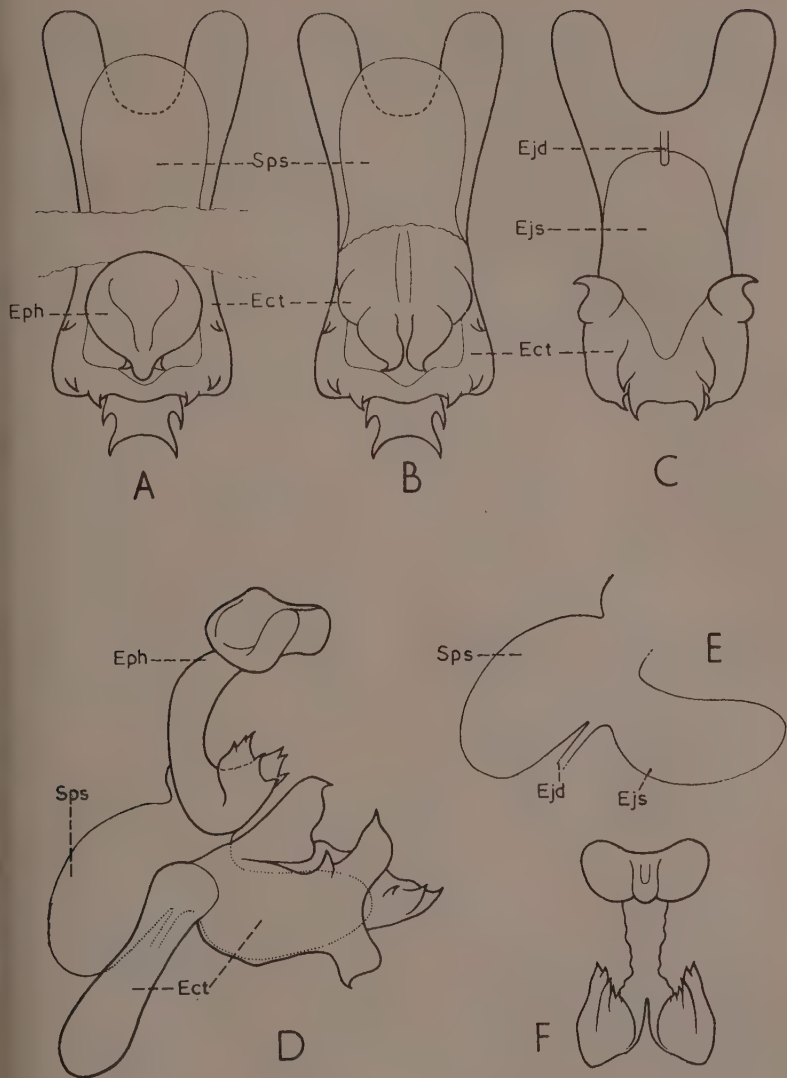
Phallic complex of *Gomphomastax clavata* (Ostr.)



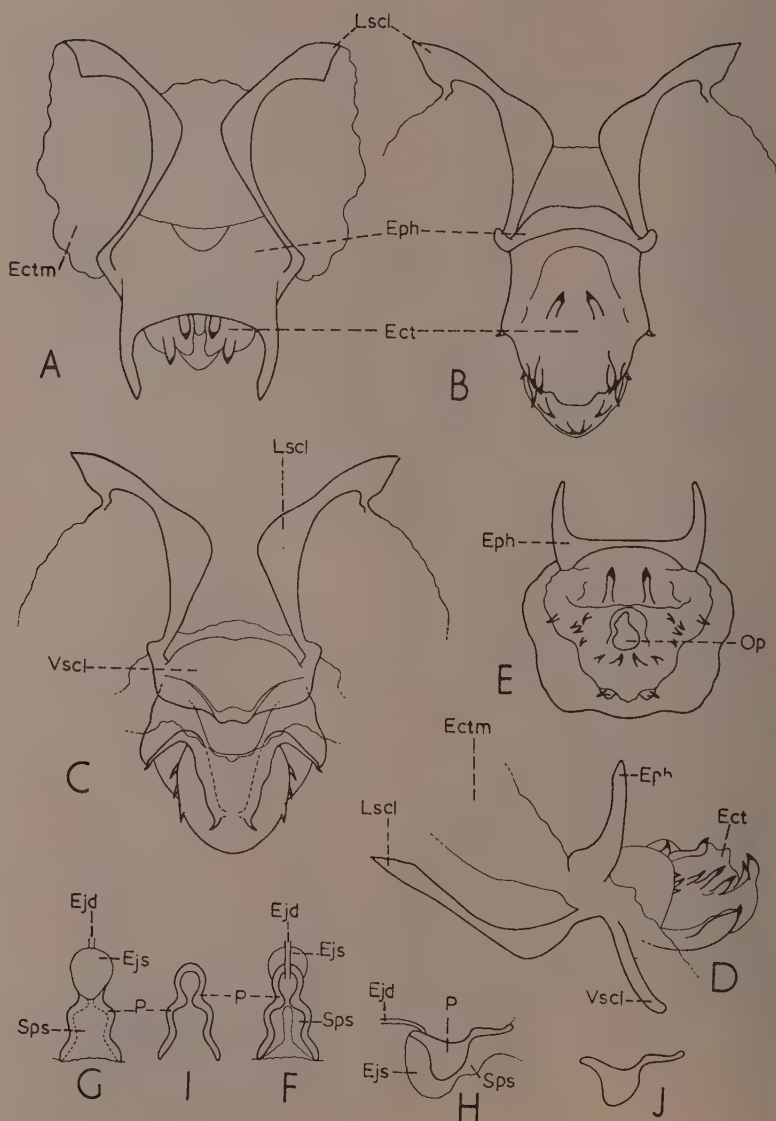
Phallic complex of *Biroella gracilis* C. Bol.



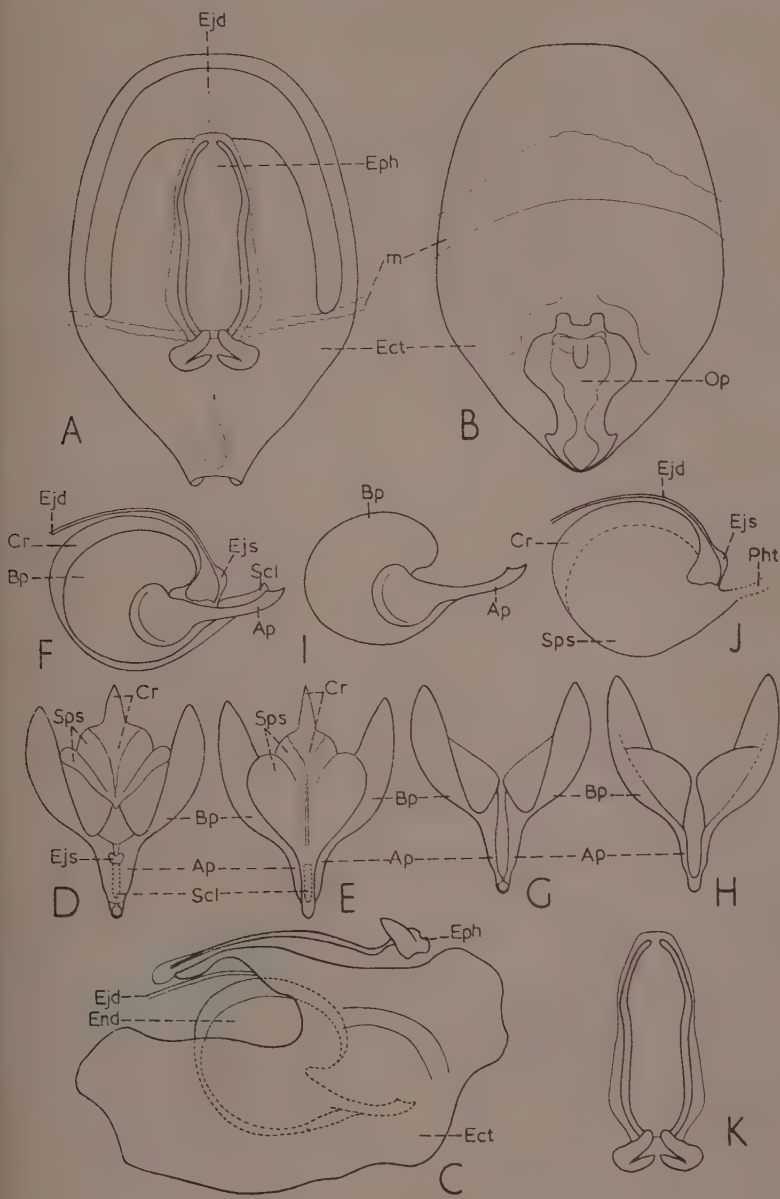
Phallic complex of *Moraba* sp.



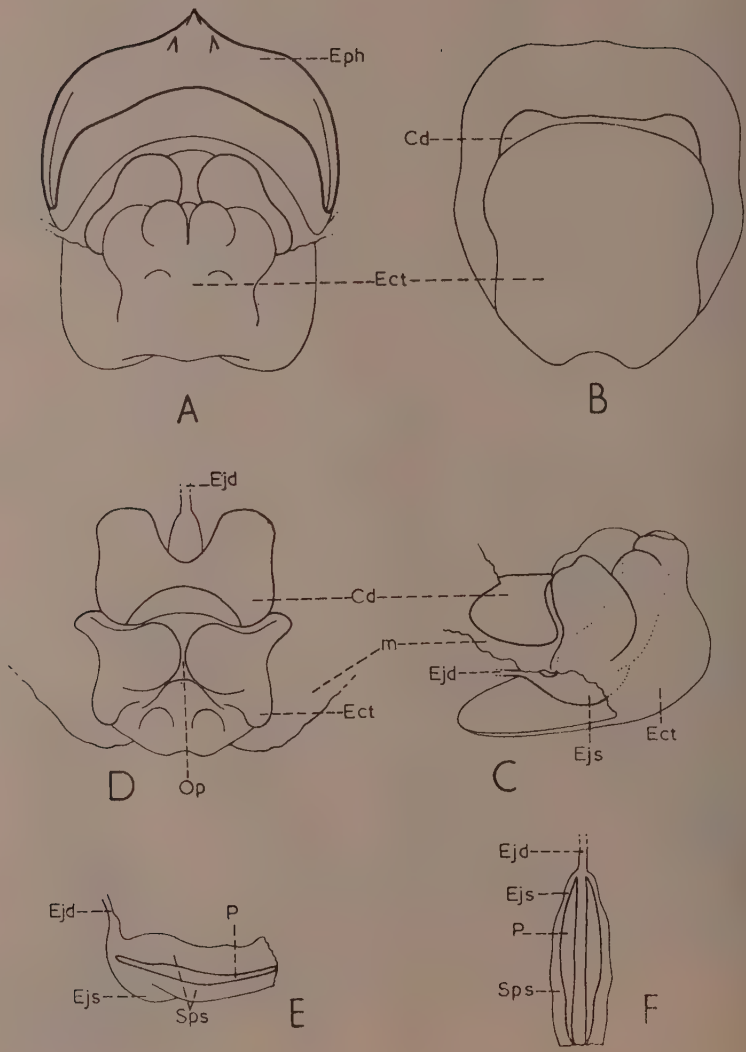
Phallic complex of *Erianthus guttatus* (Westw.)



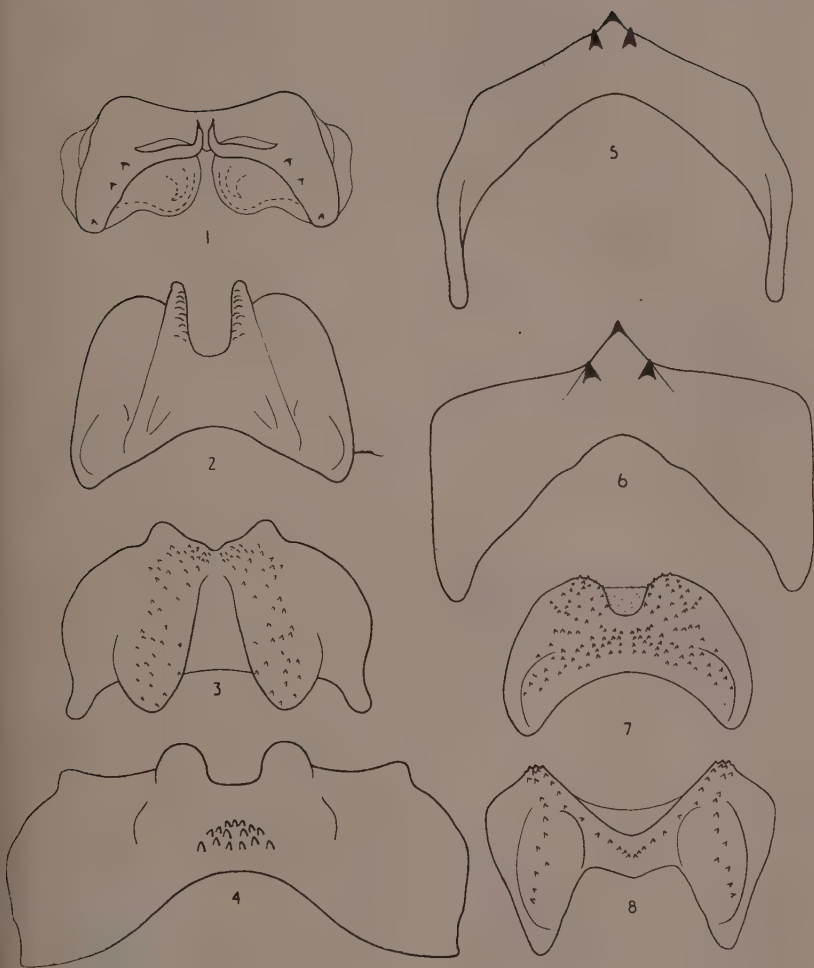
Phallic complex of *Erucius dimidiatipes* I. Bol.



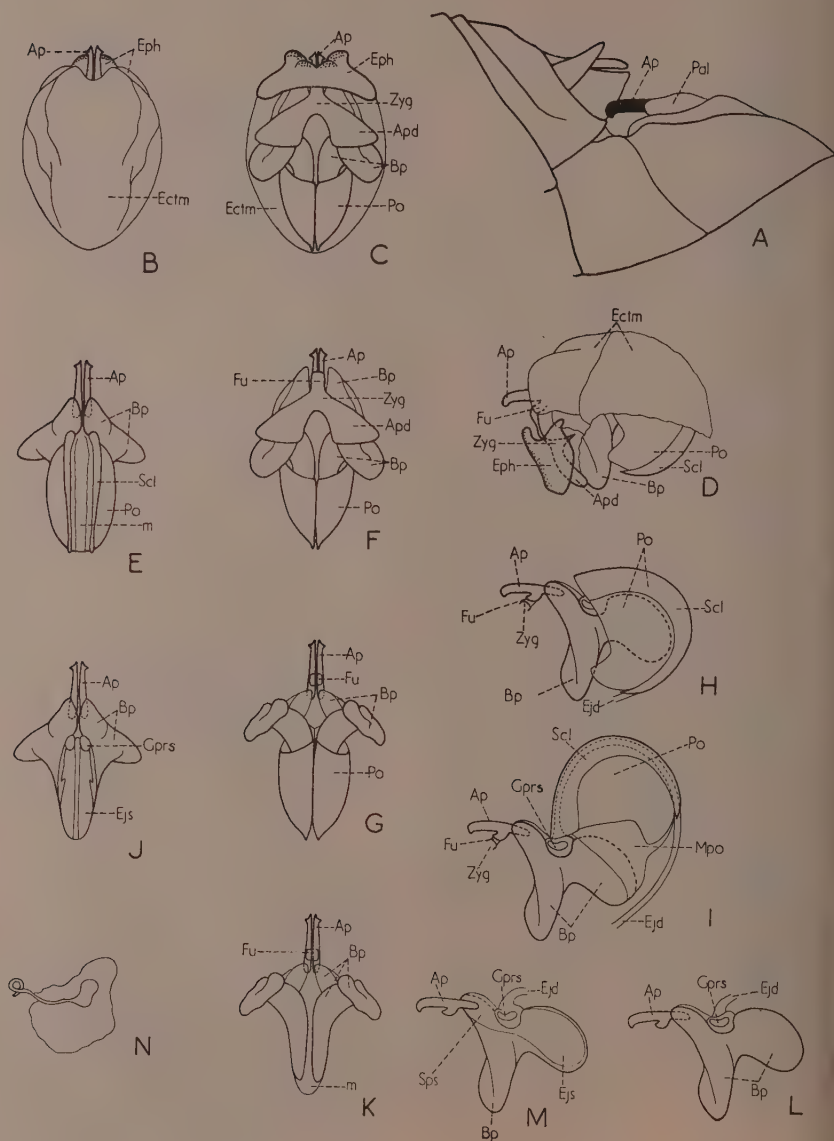
Phallic complex of *Euschmidtia burri* Uv.



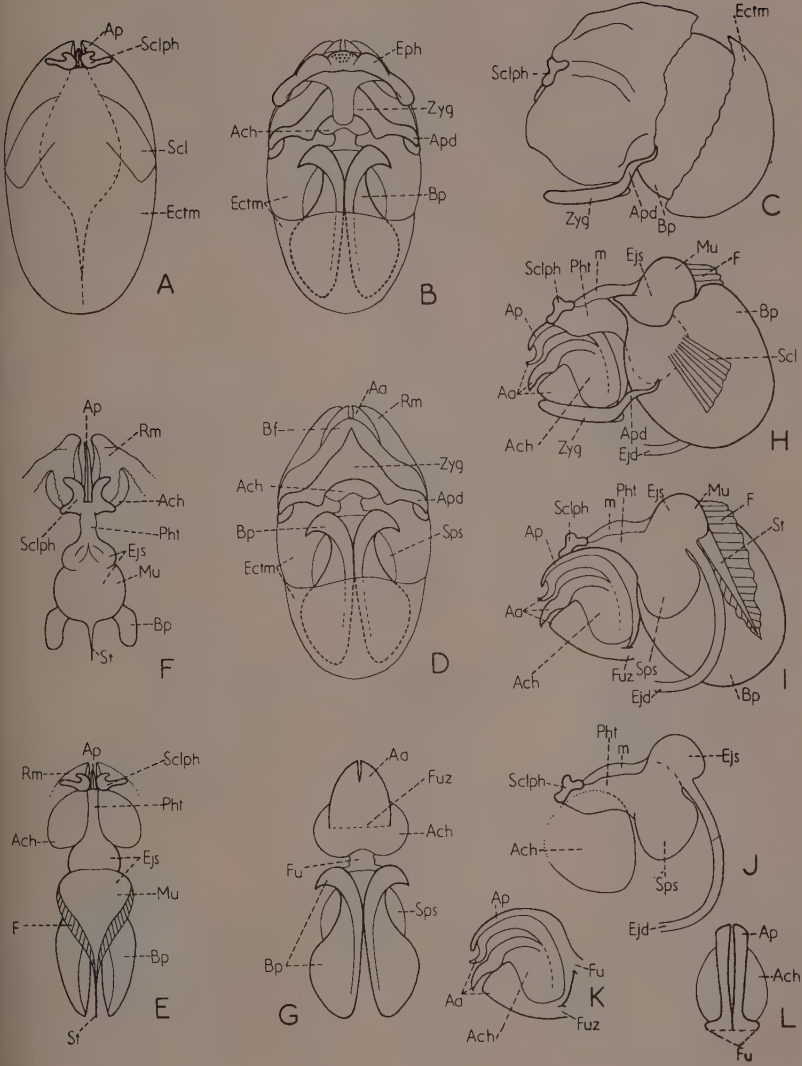
Phallic complex of *Physemacris variolosa* (L.)



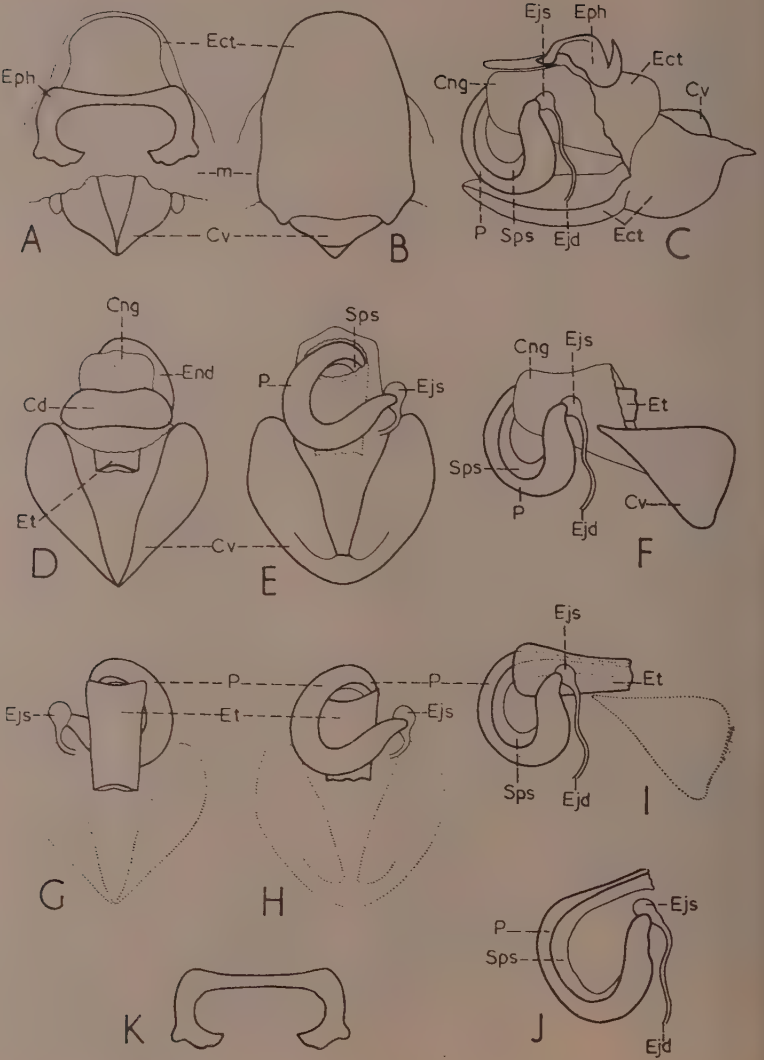
Epiphalli of Tanaoceridae (1); Xyronotidae (2); Trigonopterygidae (3, 4);
Pneumoridae (5-8)



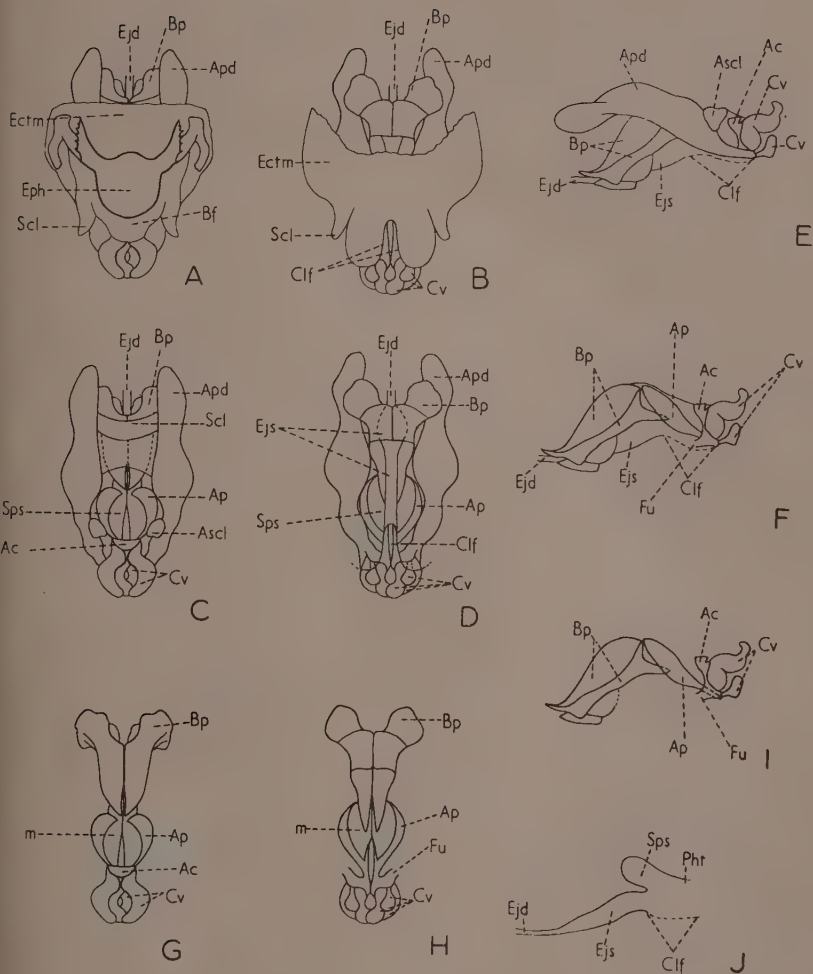
Phallic complex of *Trigonopteryx hopei* Westw.



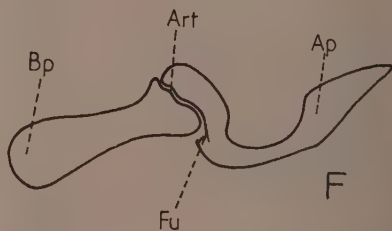
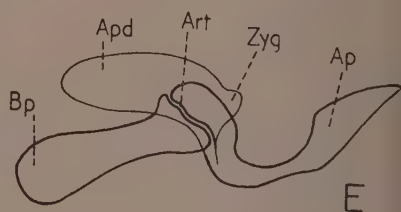
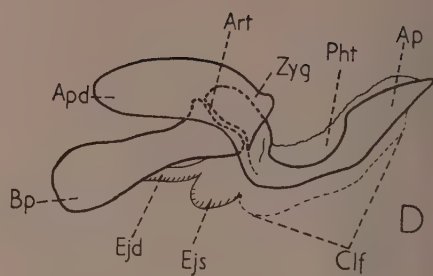
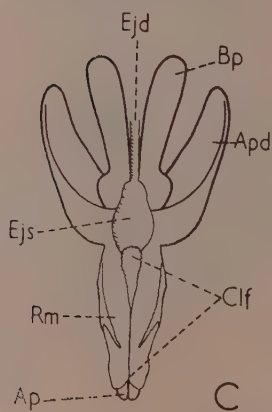
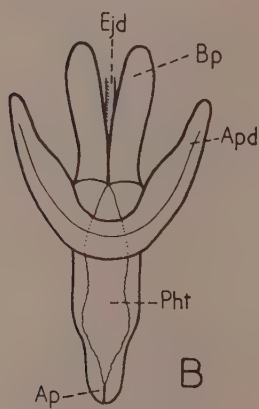
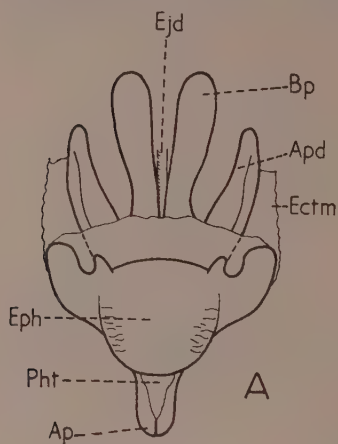
Phallic complex of *Systella rafflesii* Westw.



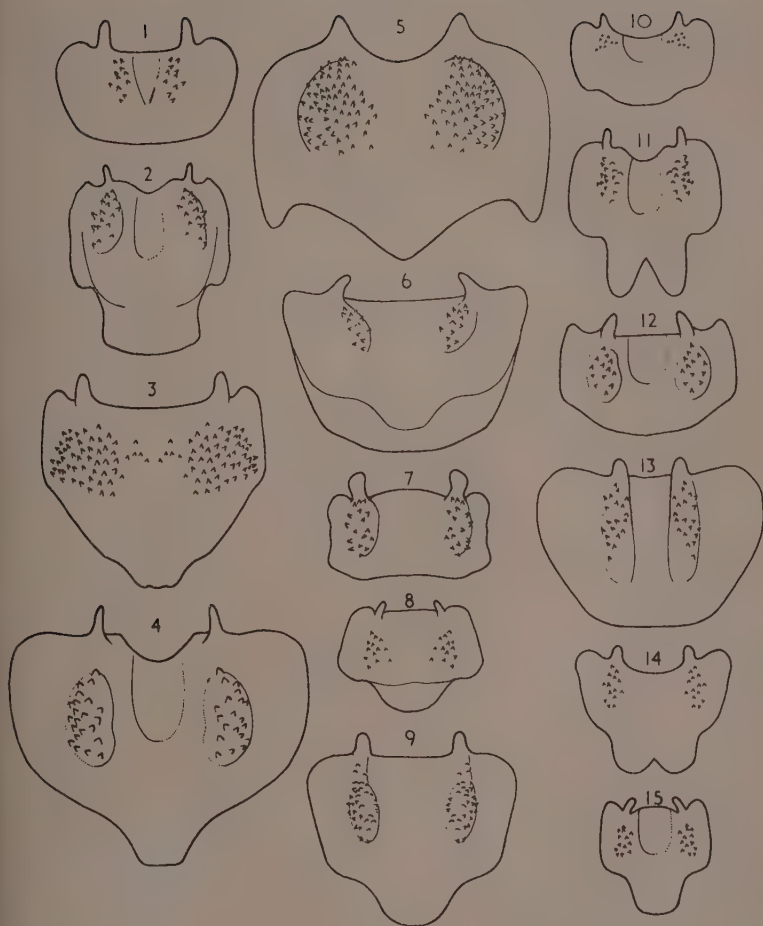
Phallic complex of *Proscopia scabra* Klug.



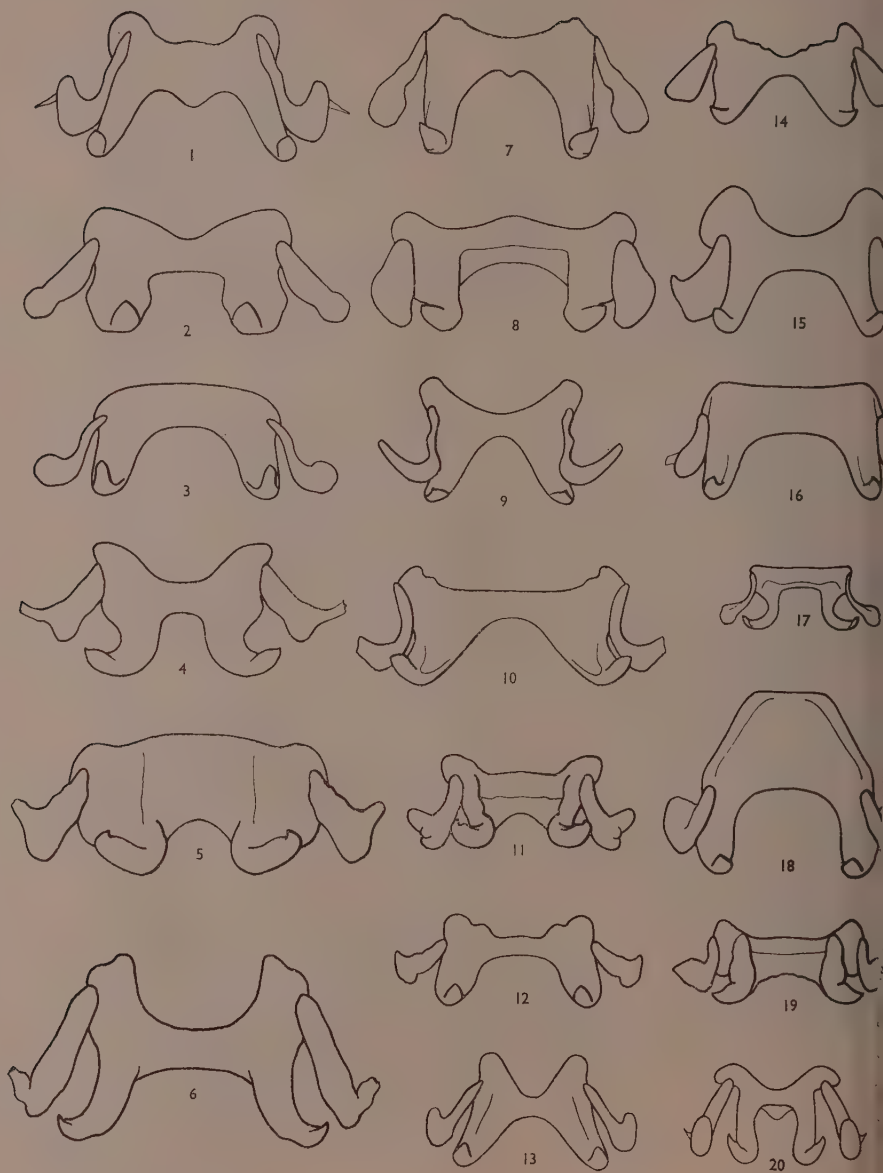
Phallic complex of *Charilaus carinatus* St.



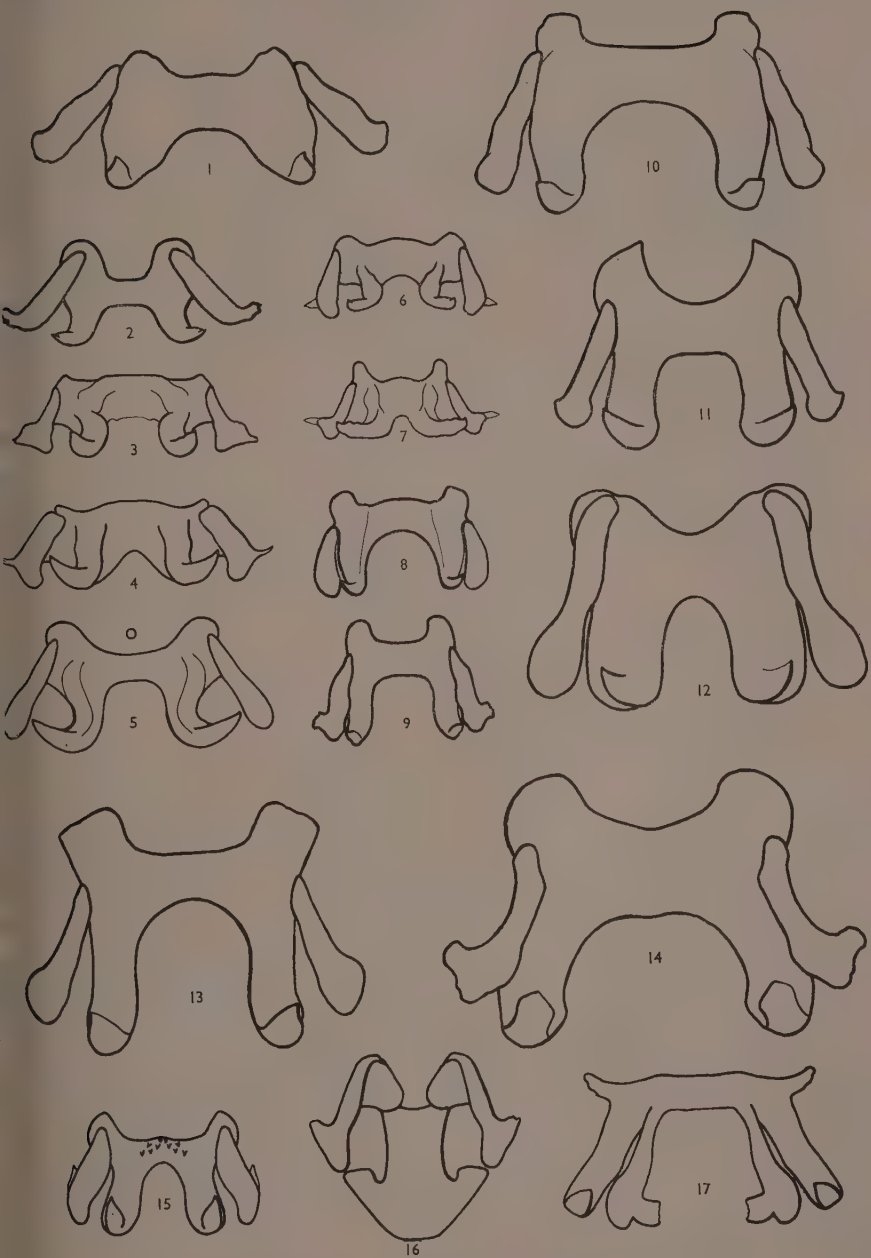
Phallic complex of *Pamphagus elephas* (L.)



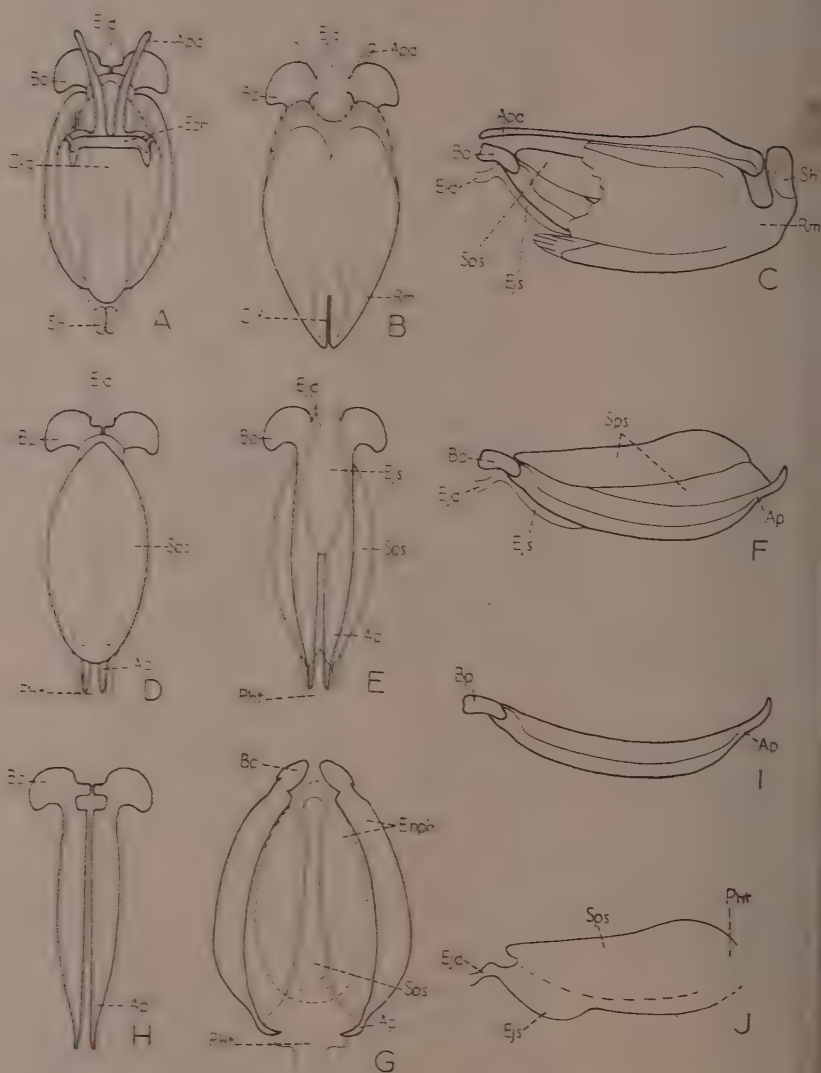
Epiphalli of Pamphagidae



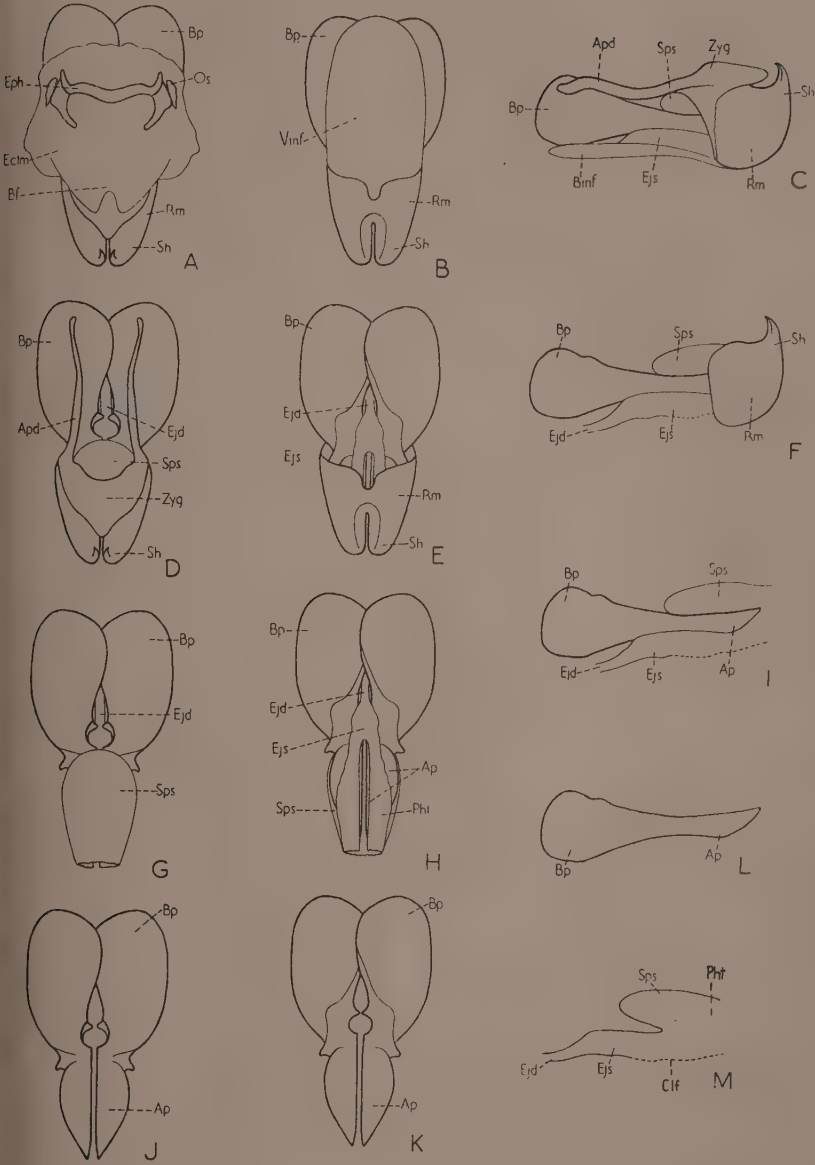
Epiphalli of Pyrgomorphidae



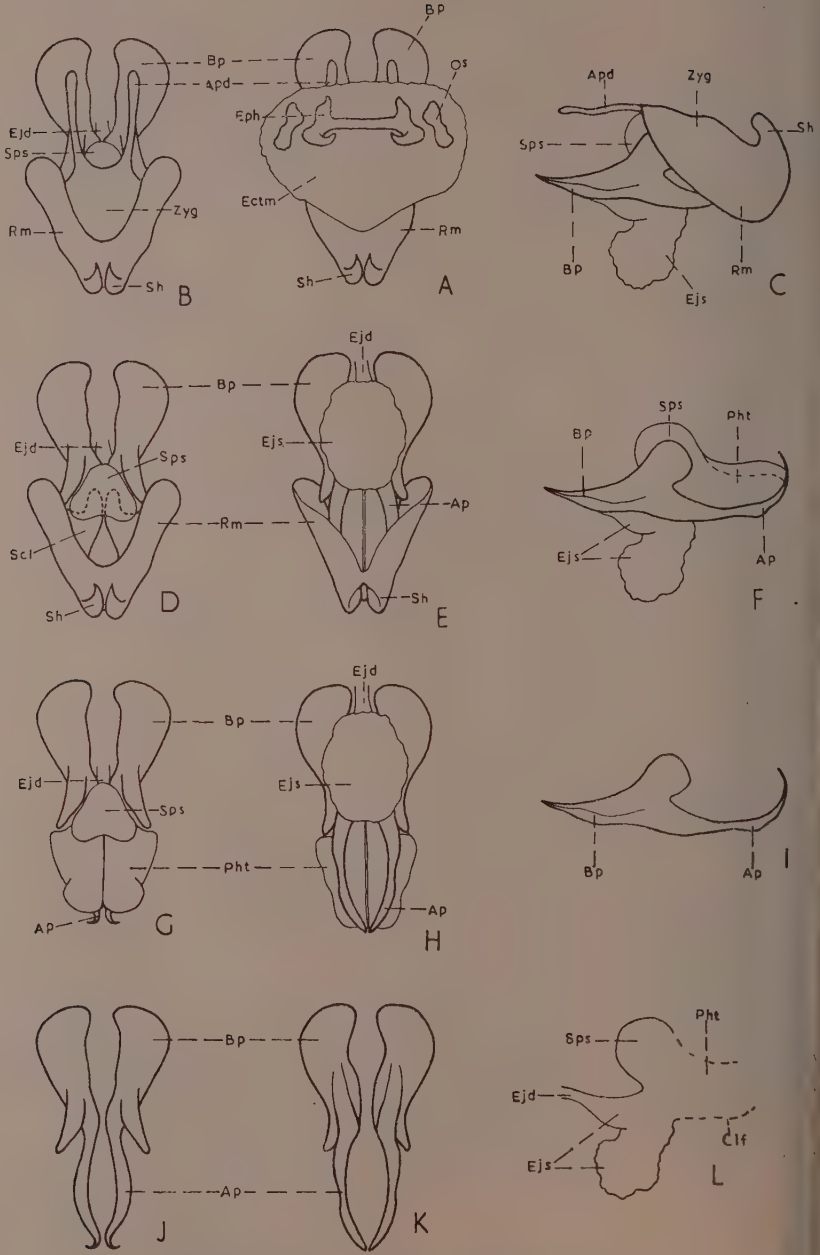
Epiphalli of Pyrgomorphidae



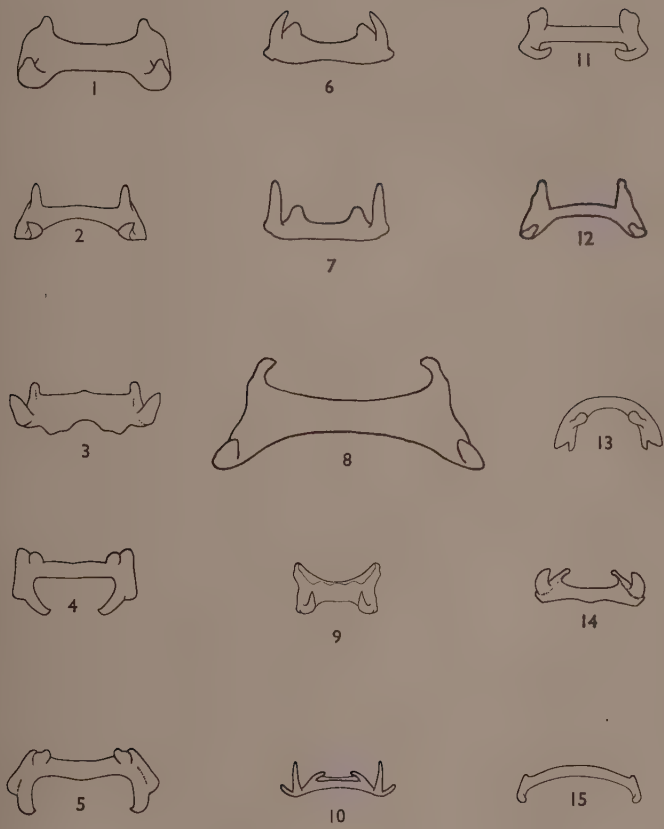
Phallic complex of *Lentula obtusifrons* St.



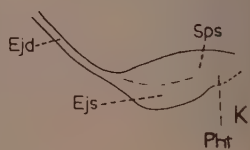
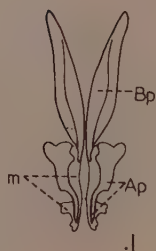
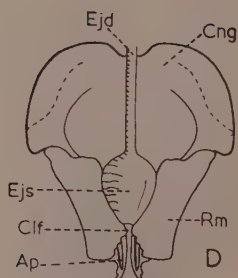
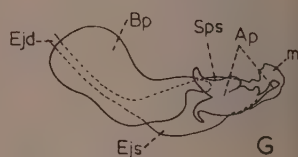
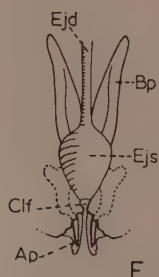
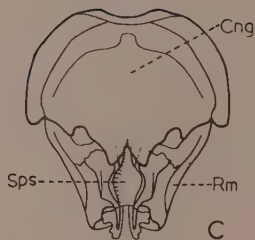
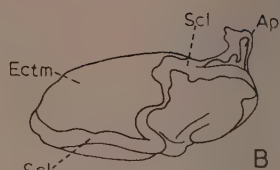
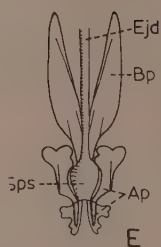
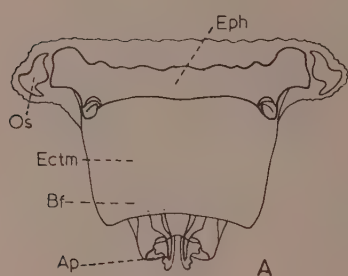
Phallic complex of *Eremidium equuleus* Karsch



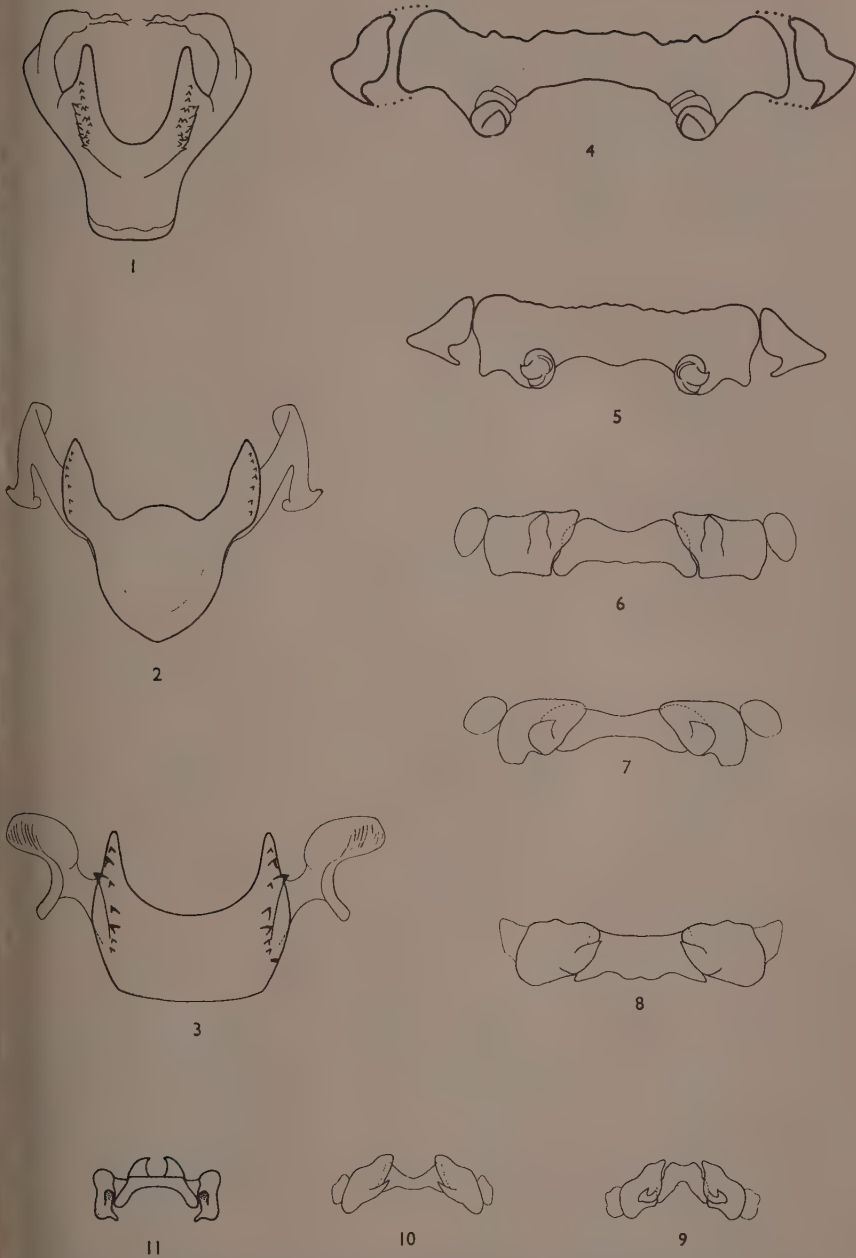
Phallic complex of *Gymnidium turbinatum* Karsch



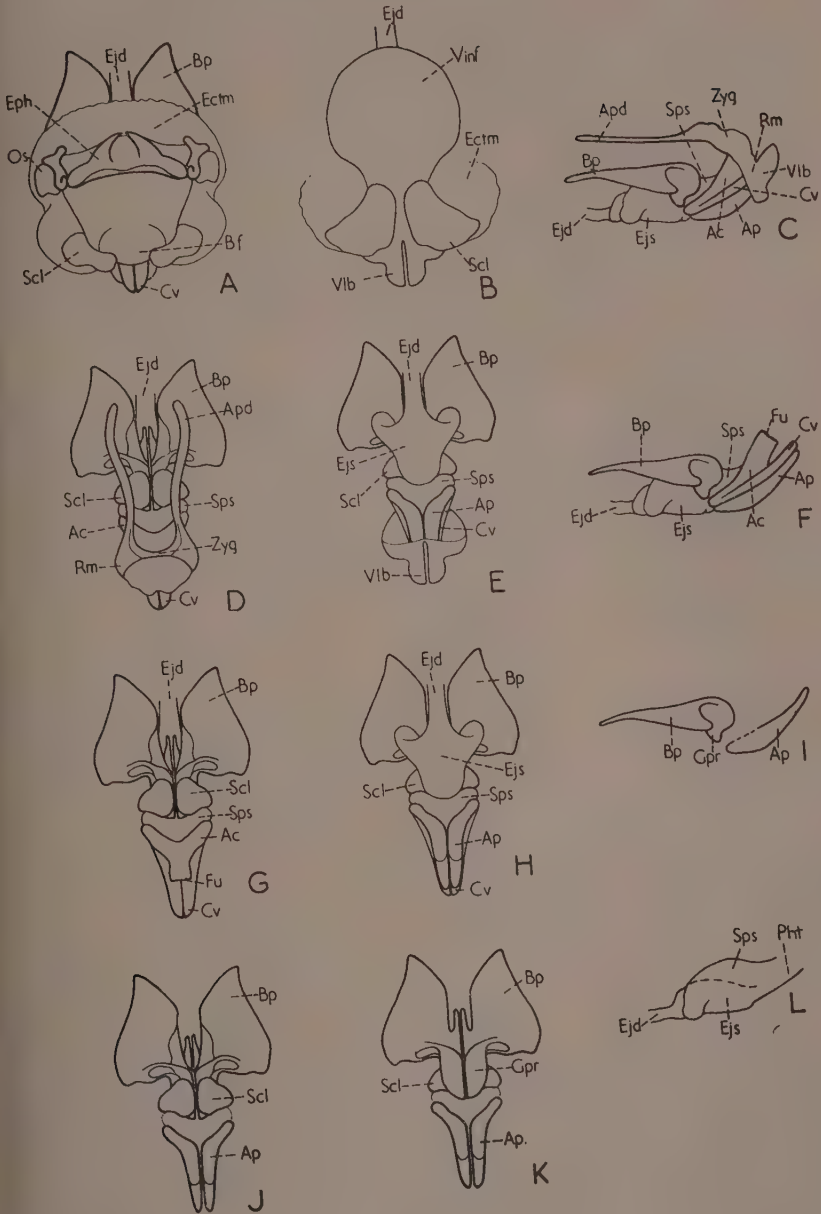
Epiphalli of *Lentulidae*



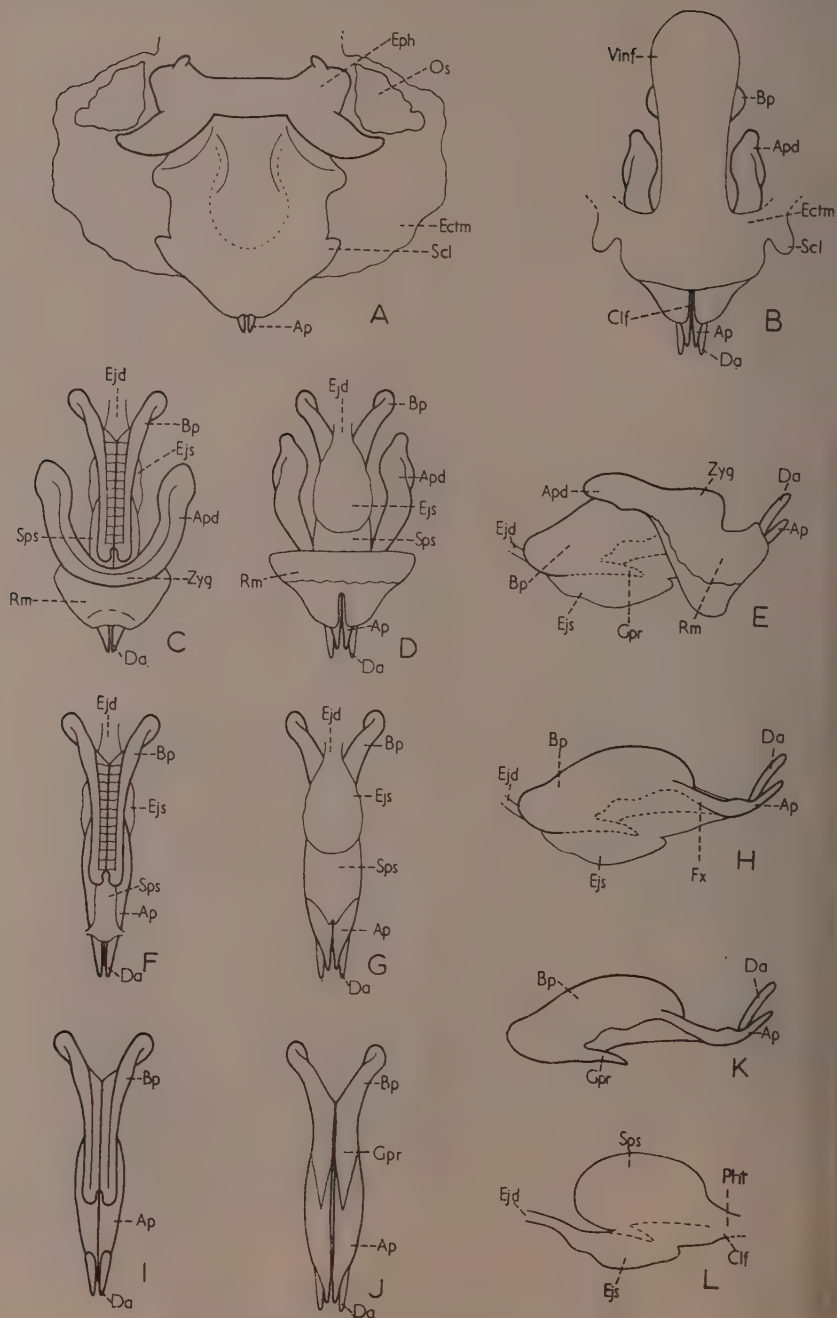
Phallic complex of *Batrachidacris rubridens* (Uv.)



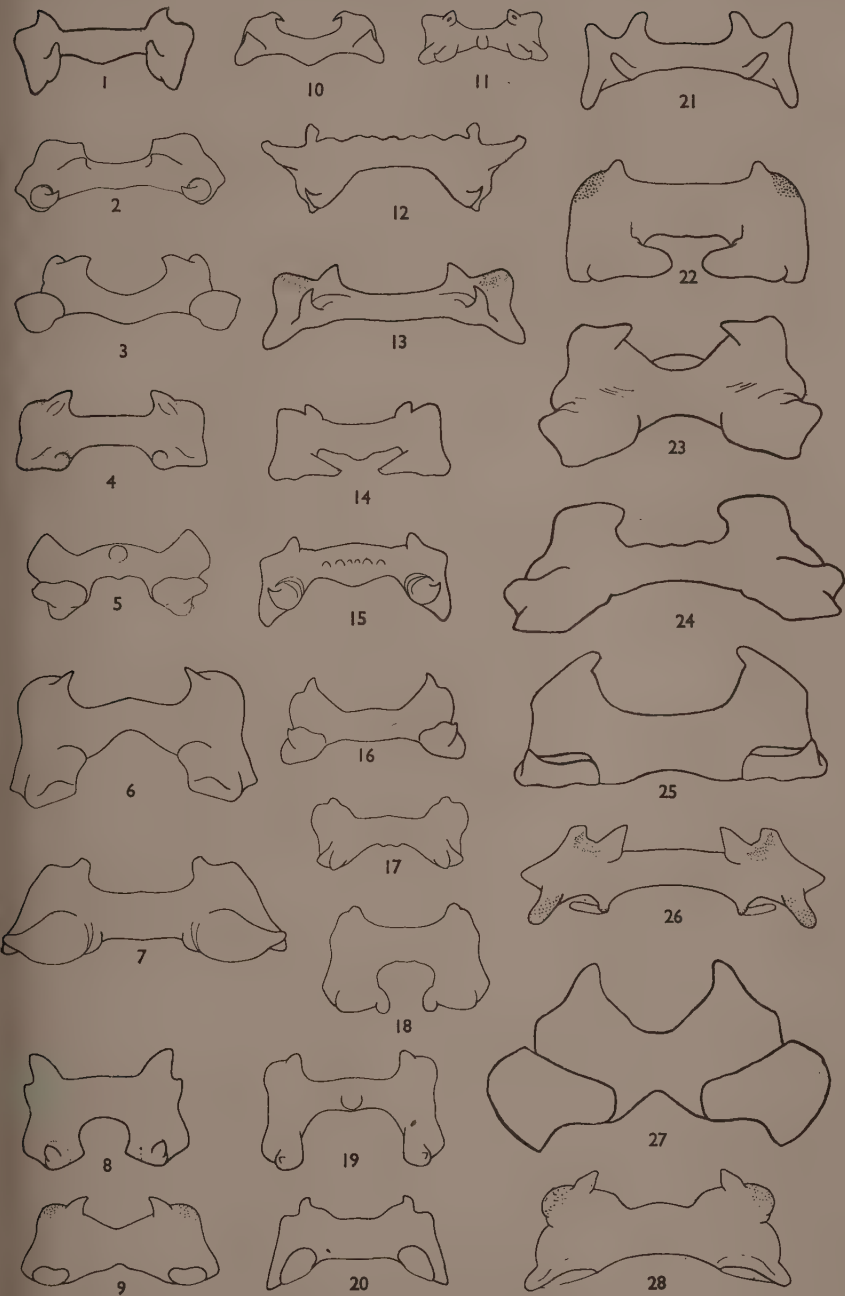
Epiphalli of Charilaidae (1-3); Lathiceridae (4, 5); Ommexechidae (6-10);
and Pauliniidae (11)



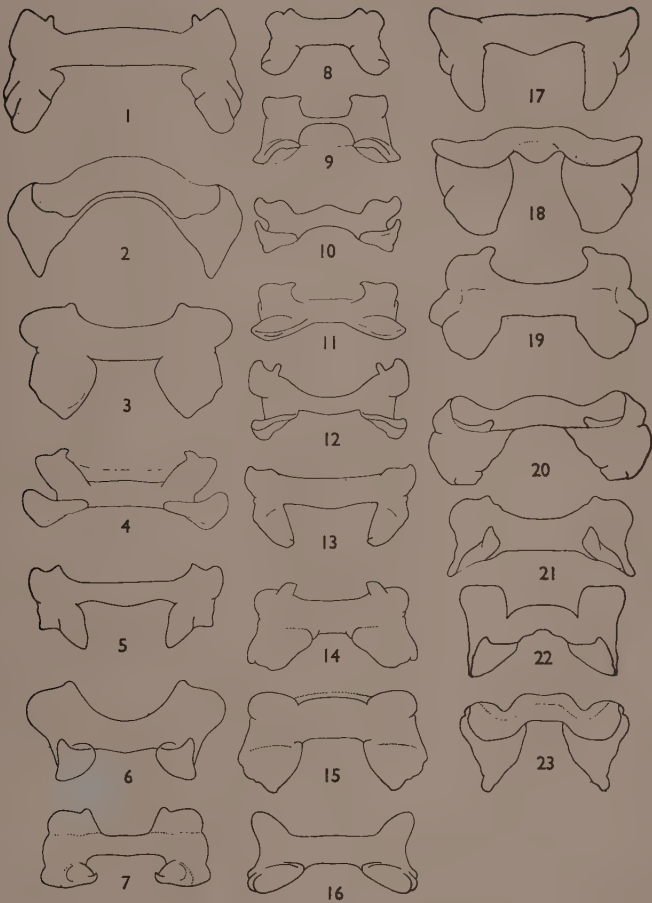
Phallic complex of *Paulinia acuminata* (De Geer)



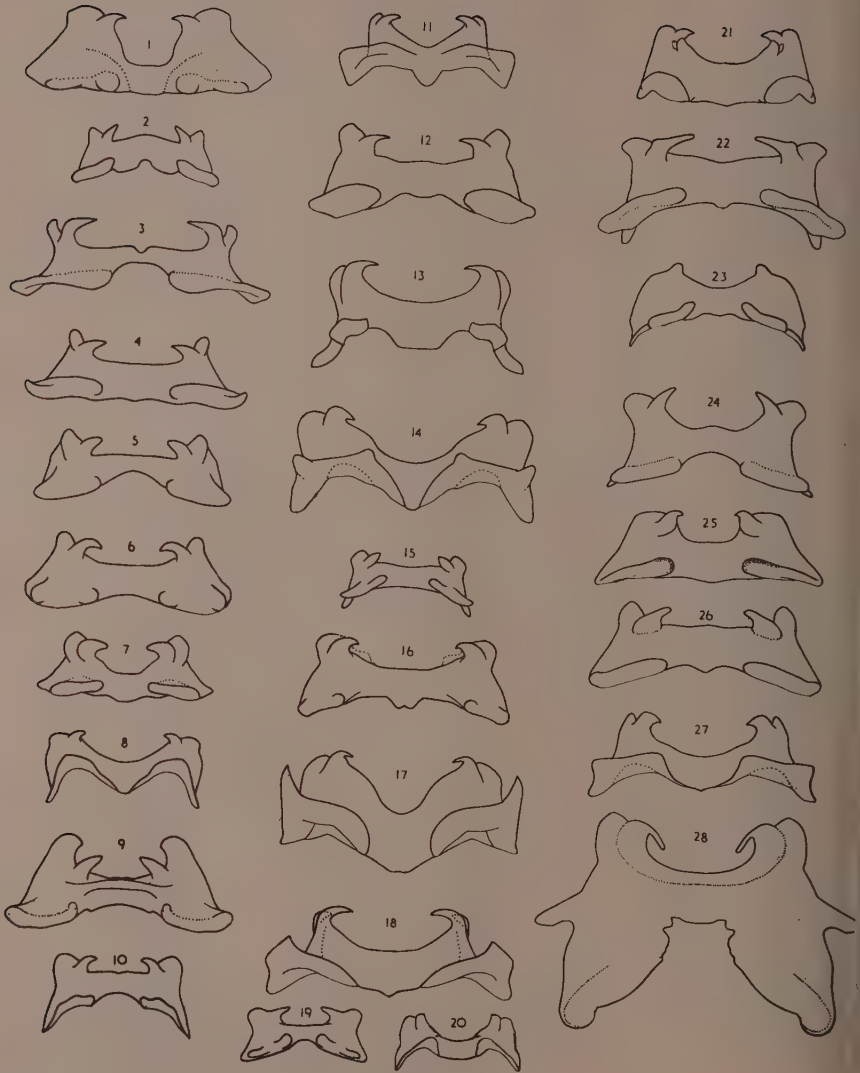
Phallic complex of *Romalea microptera* (Beauv.)



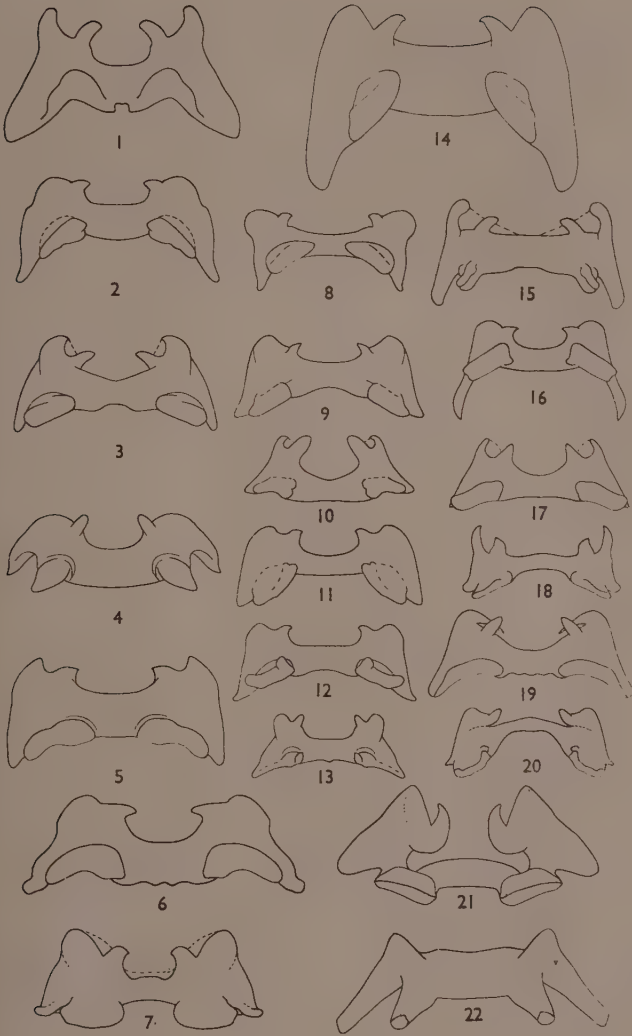
Epiphalli of Romaleinae



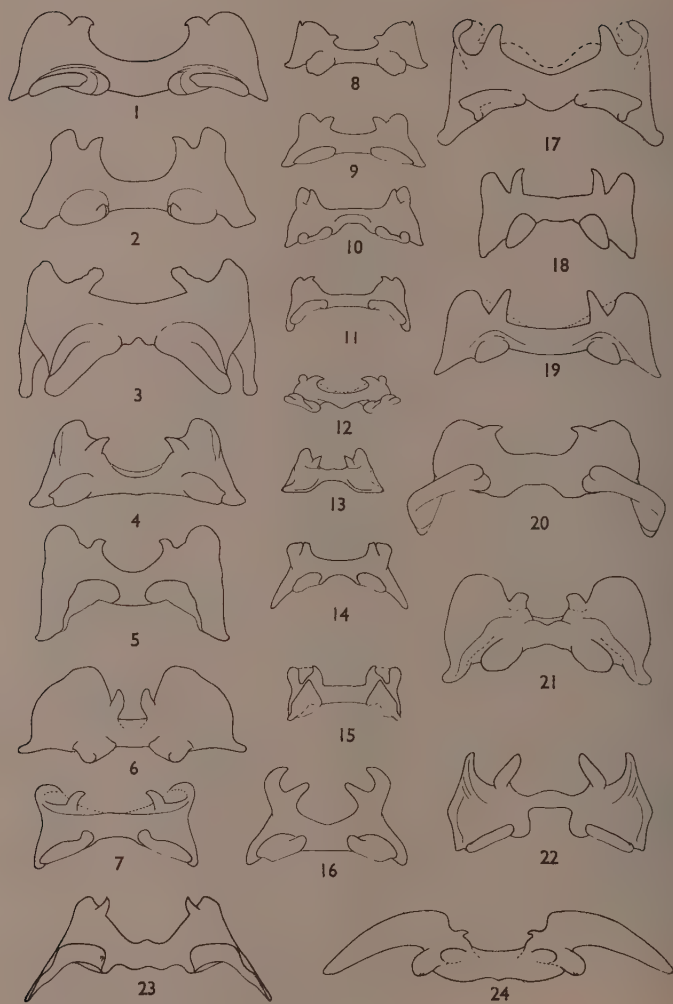
Epiphalli of *Cyrtacanthacres*



Epiphalli of *Catantopes*



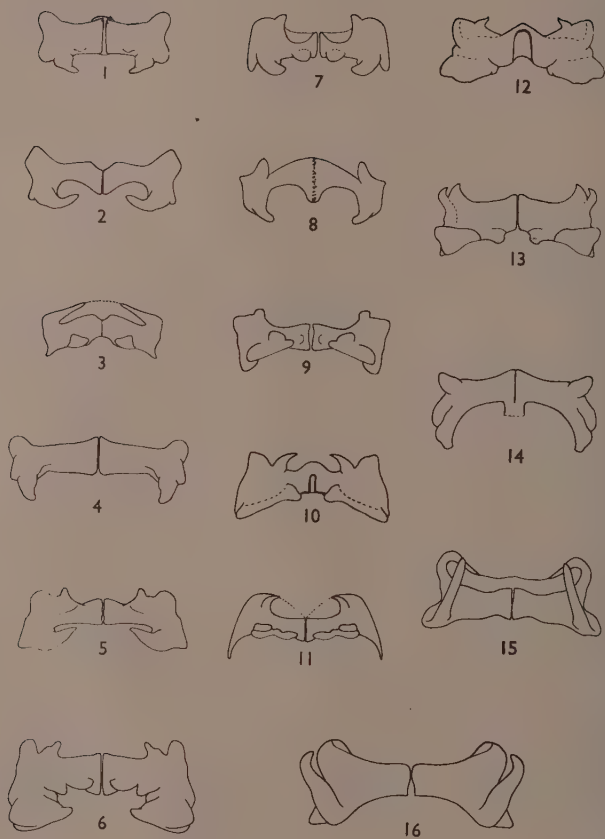
Epiphalli of Podismae



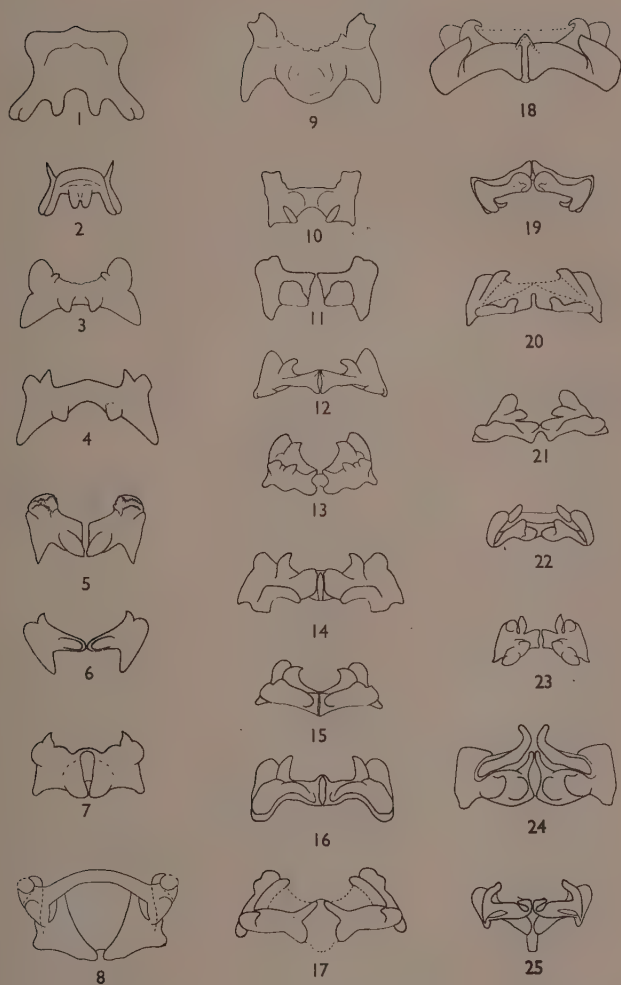
Epiphalli of Podismae



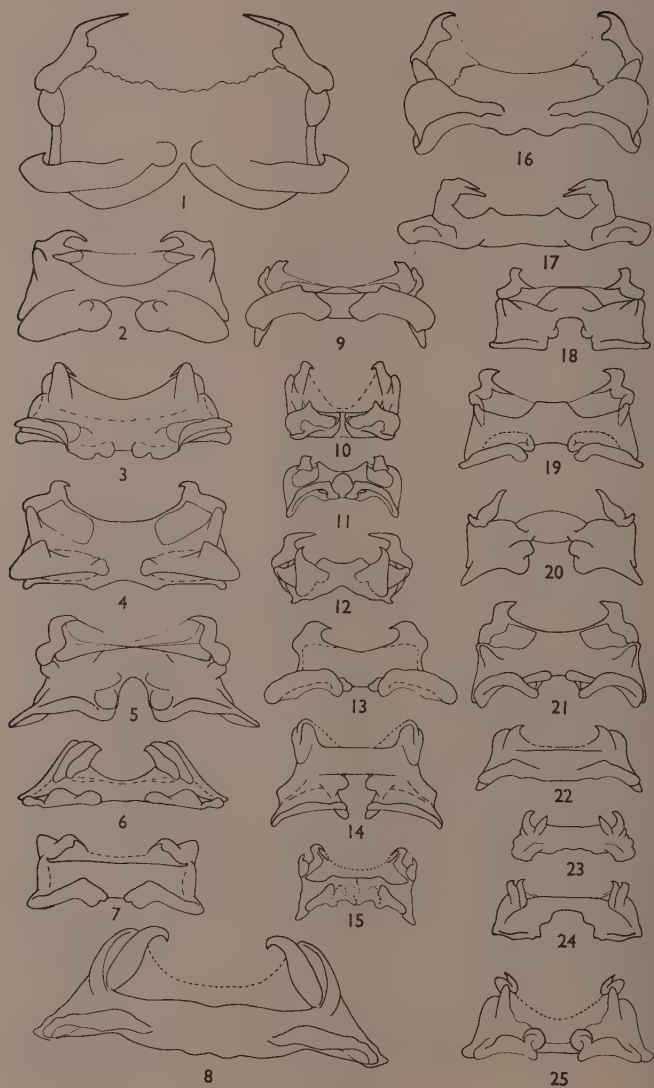
Epiphalli of *Dericorythi* (1); *Apobolei* (2, 3); *Serpusiae* (4-7);
Conophymae (8-14); *Oxyrrhepes* (15-19); *Tropidopolae* (20-24)



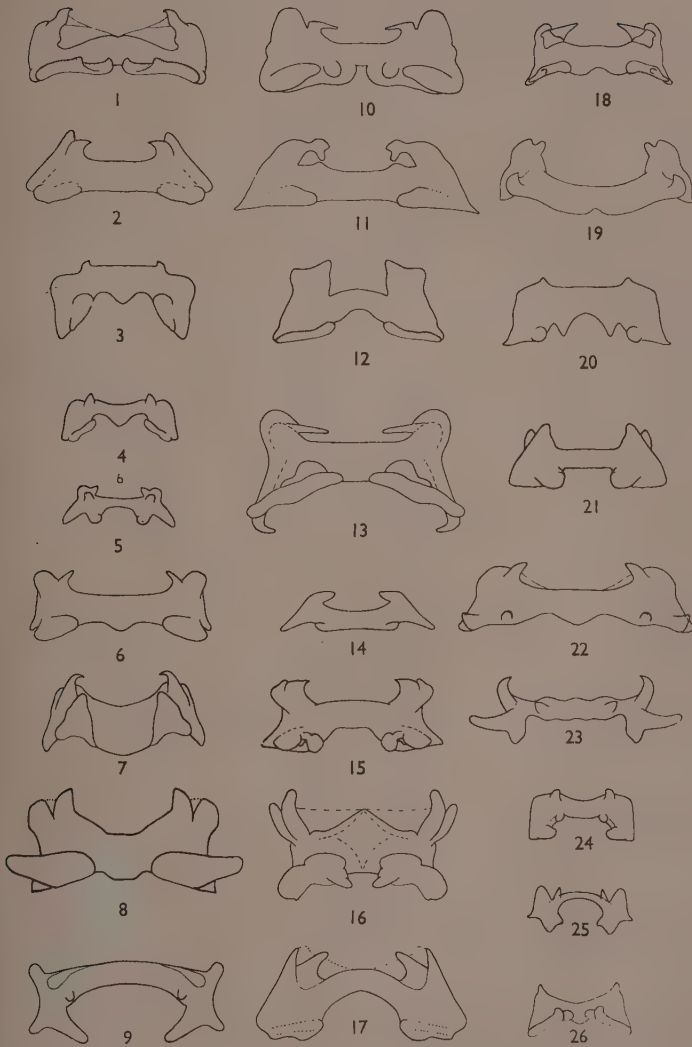
Epiphalli of *Oxyae*



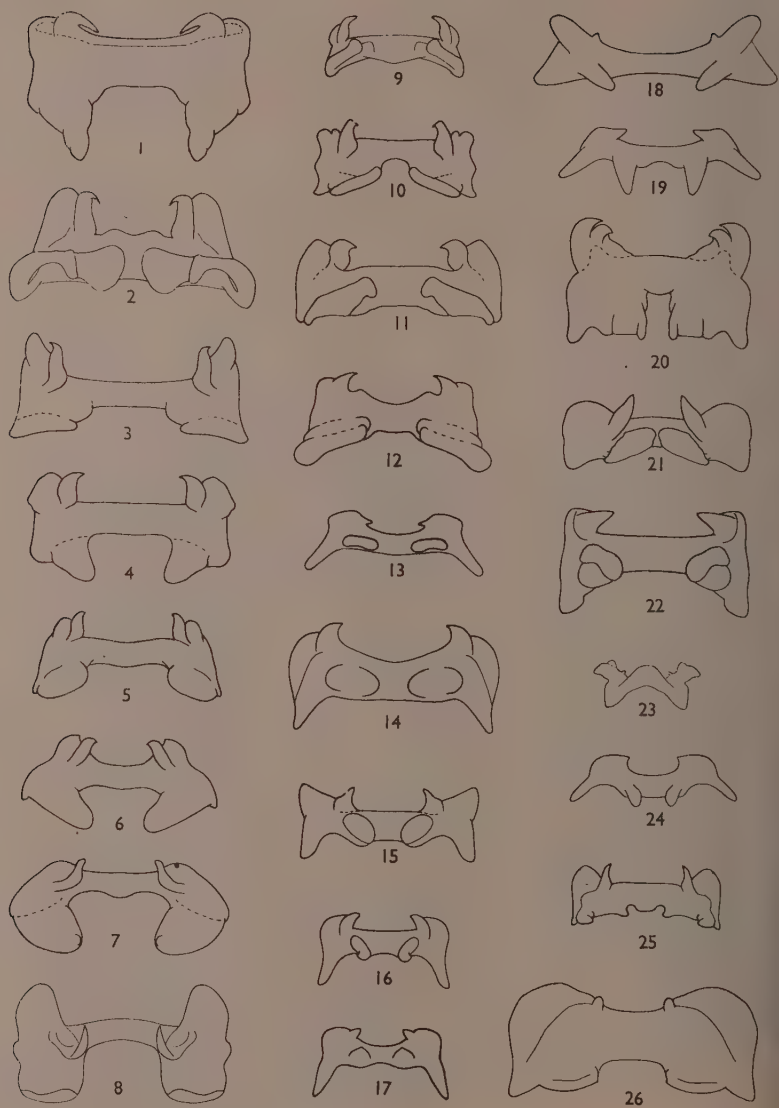
Epiphalli of *Leptismae* (1-11); *Coptacrae* (12-25)



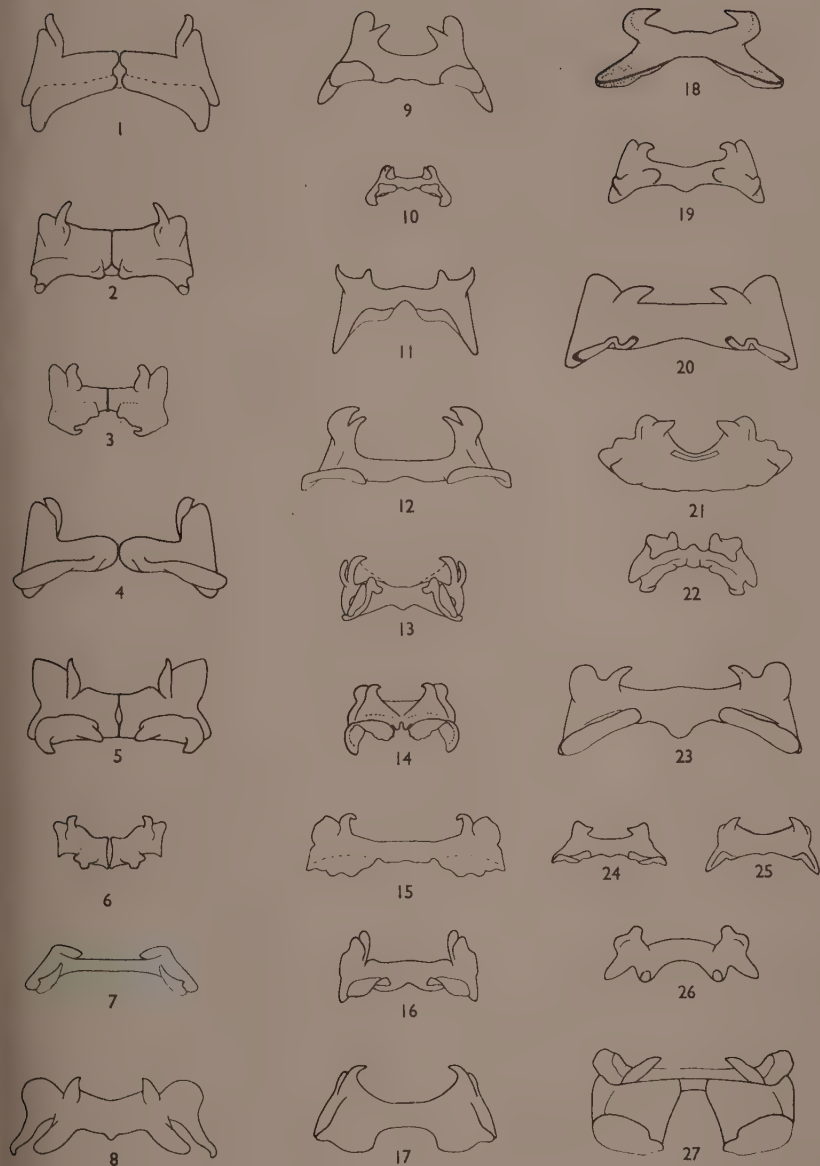
Epiphalli of *Eyprepocnemes*



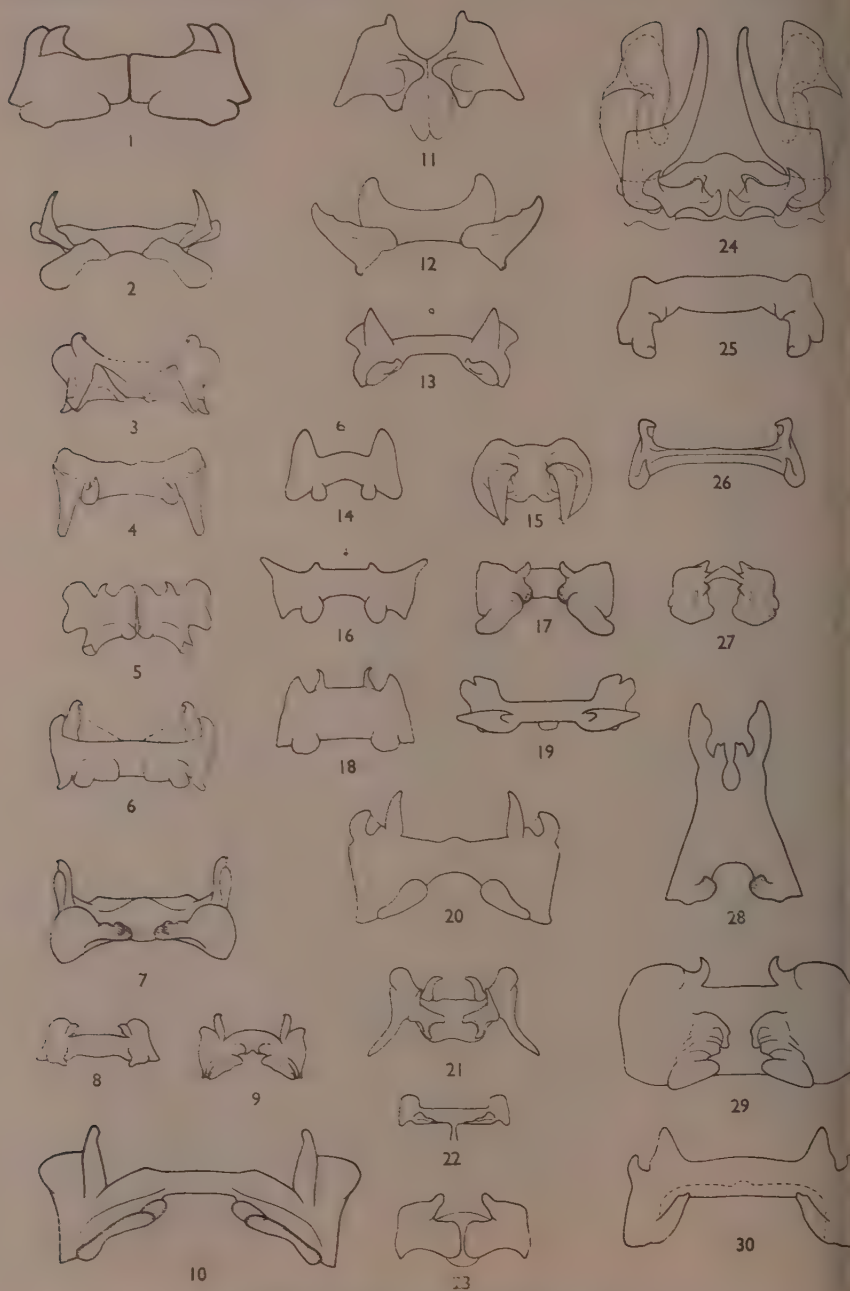
Epiphalli of ungrouped genera of Catantopinae



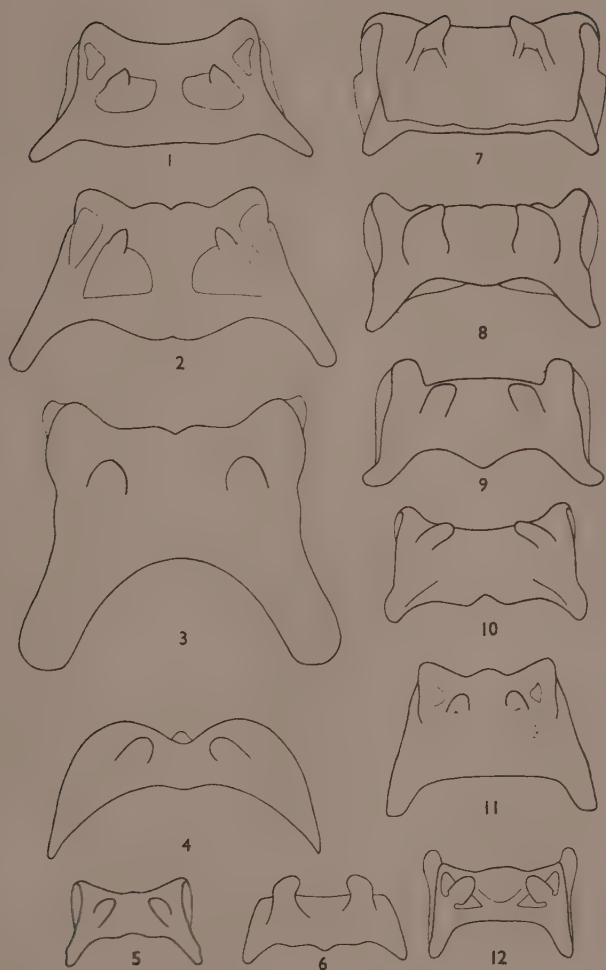
Epiphalli of ungrouped genera of Catantopinae



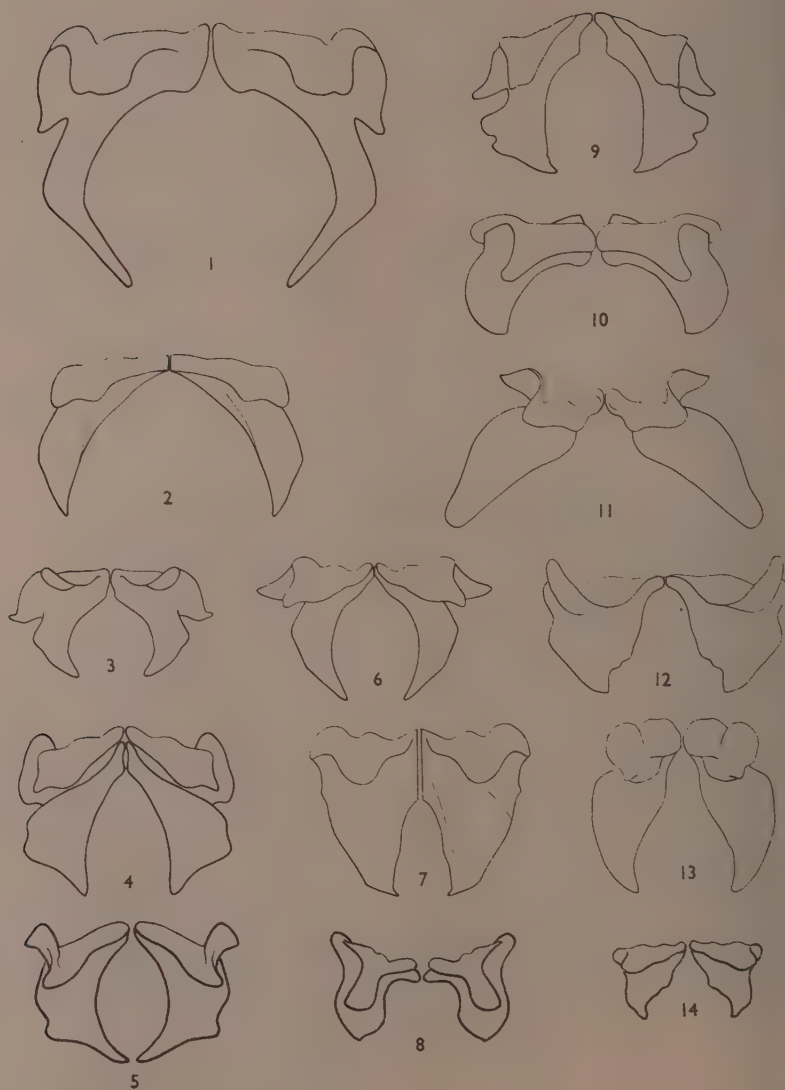
Epiphalli of ungrouped genera of Catantopinae



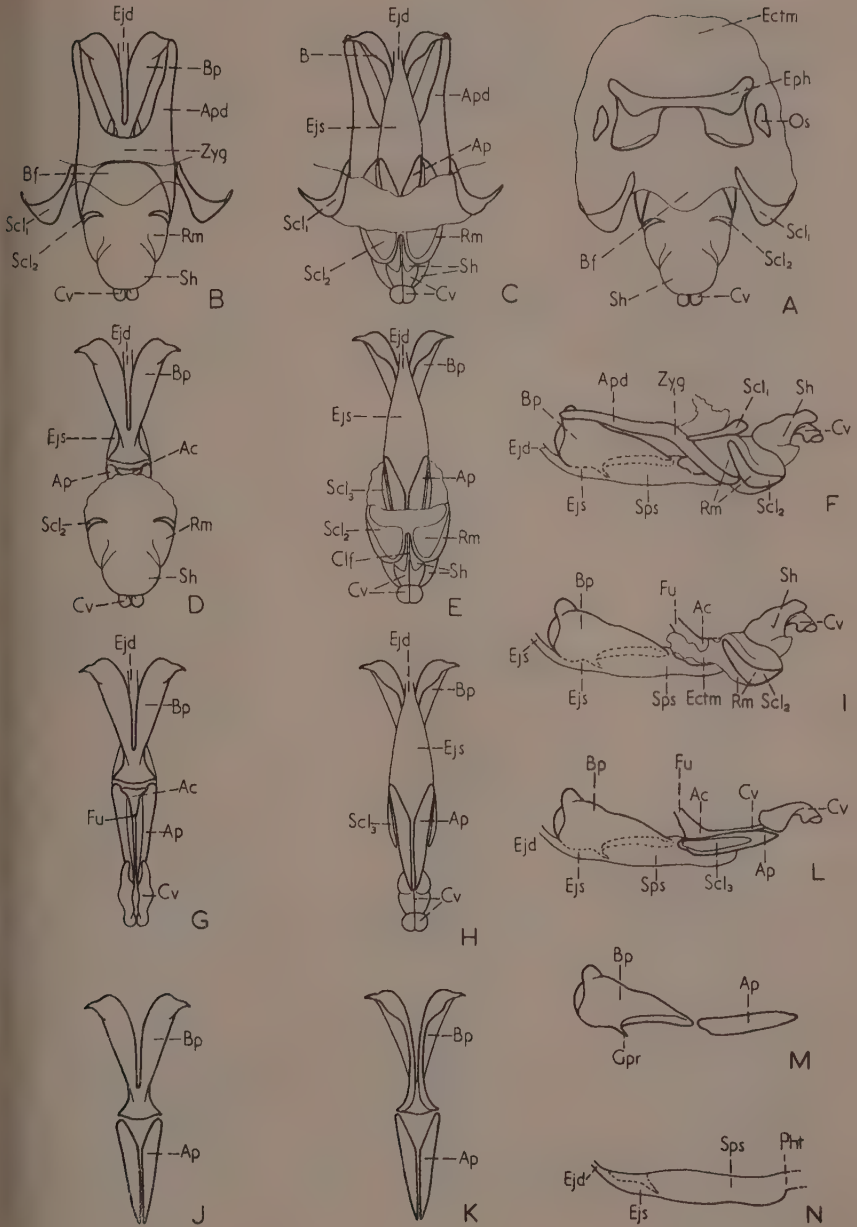
Epiphalli of ungrouped genera of Catantopinae (1-23); and genera of uncertain position (24-30)



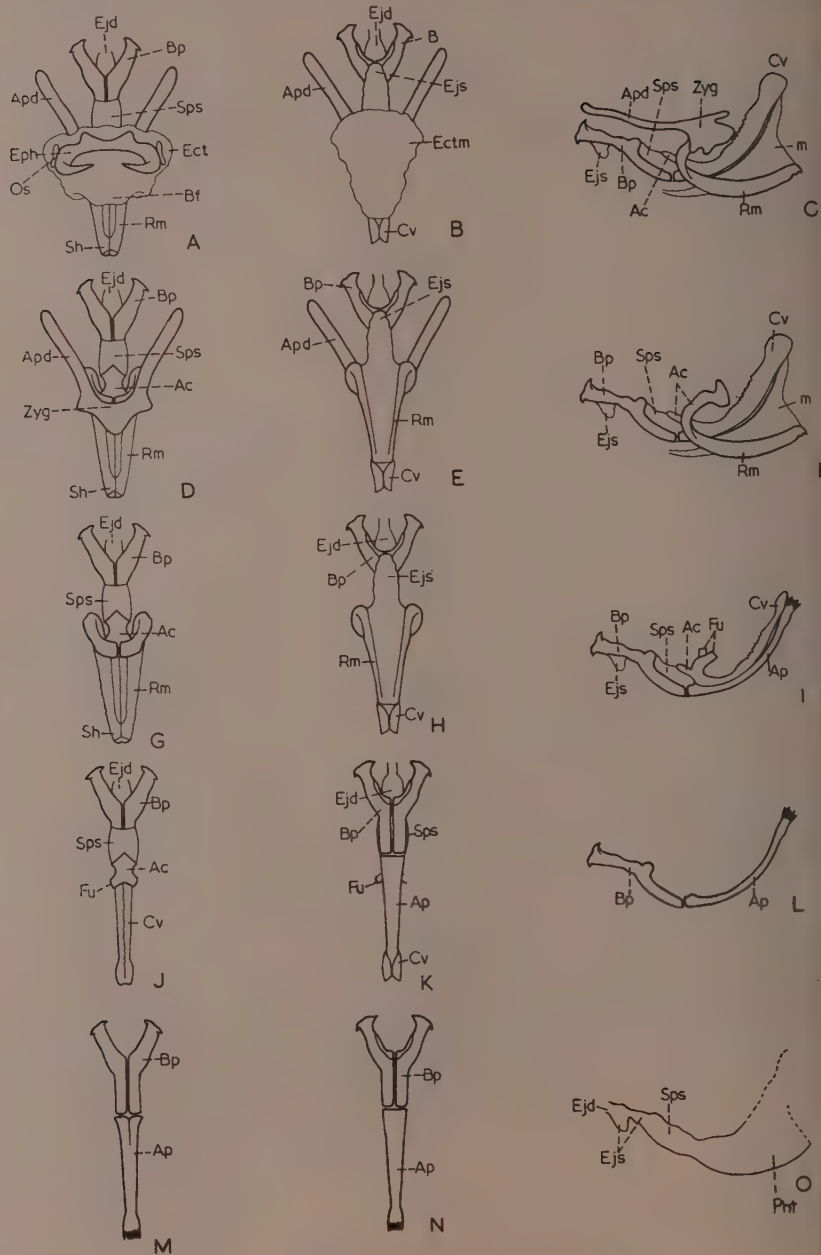
Epiphalli of Calliptaminae



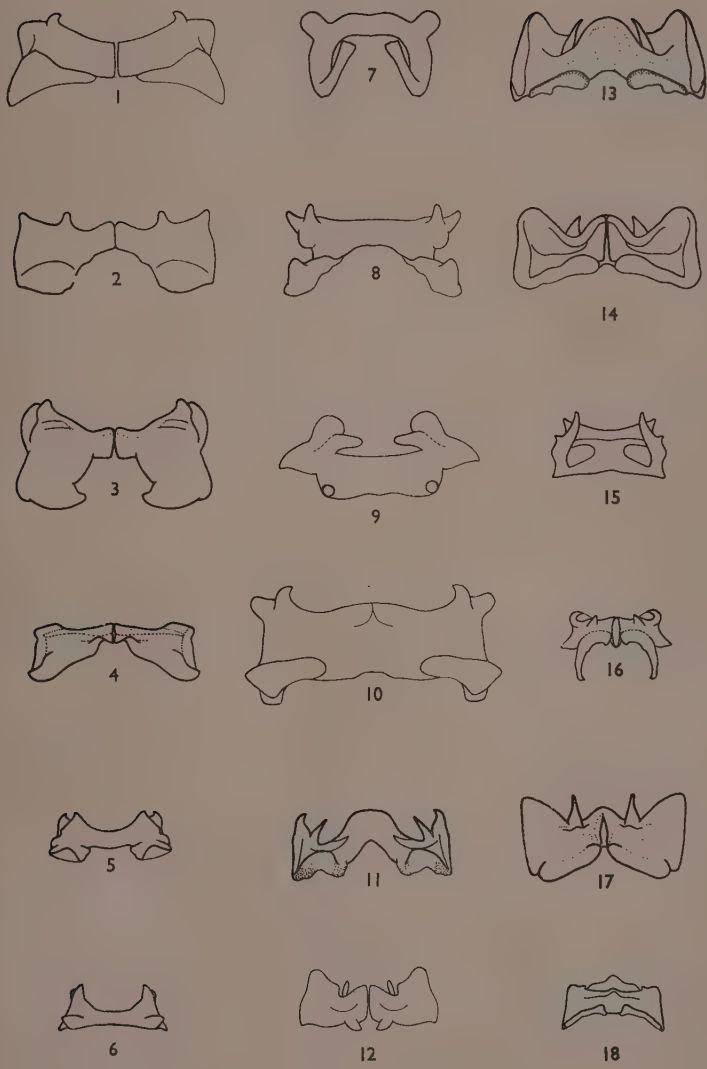
Epiphalli of Euryphyminae



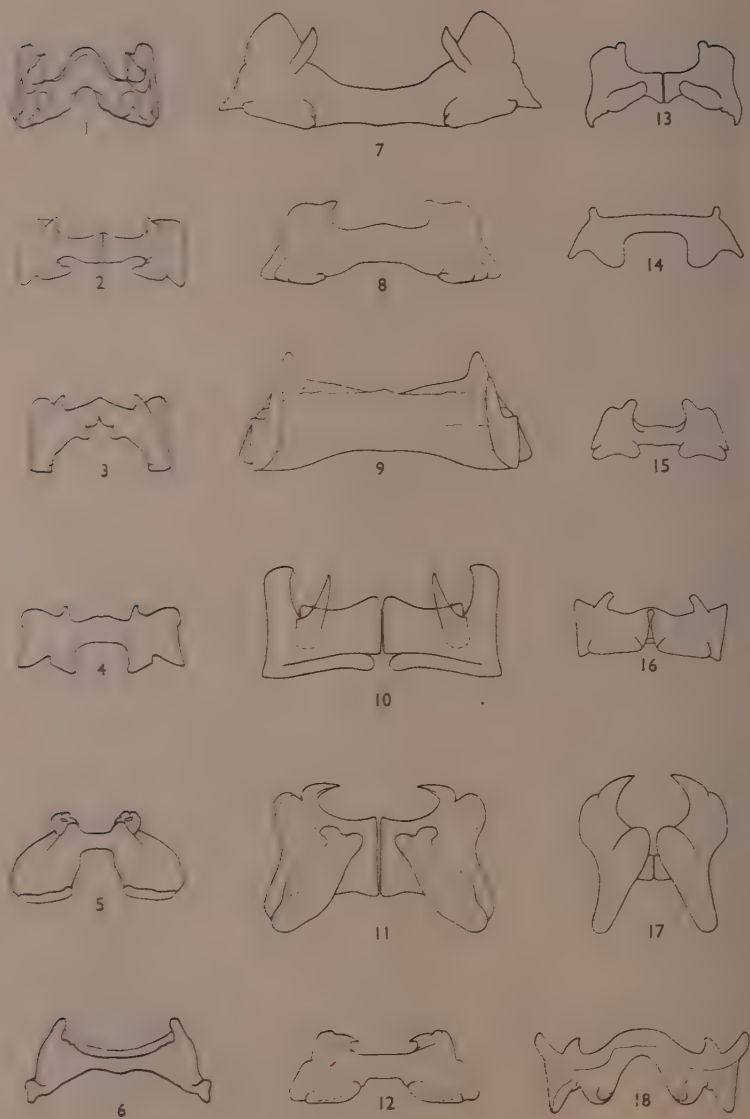
Phallic complex of *Hemicris fervens* Walk.



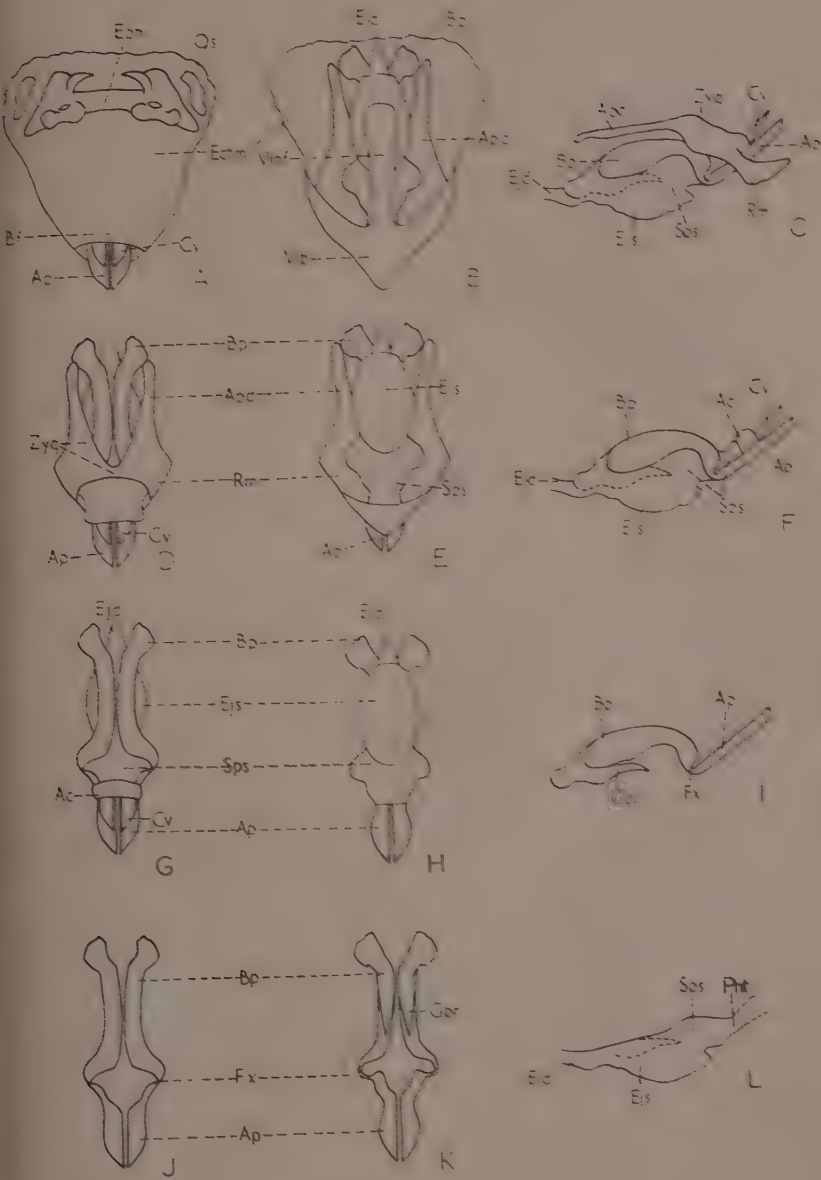
Phallic complex of *Tarbaleus cingalensis* Kirby



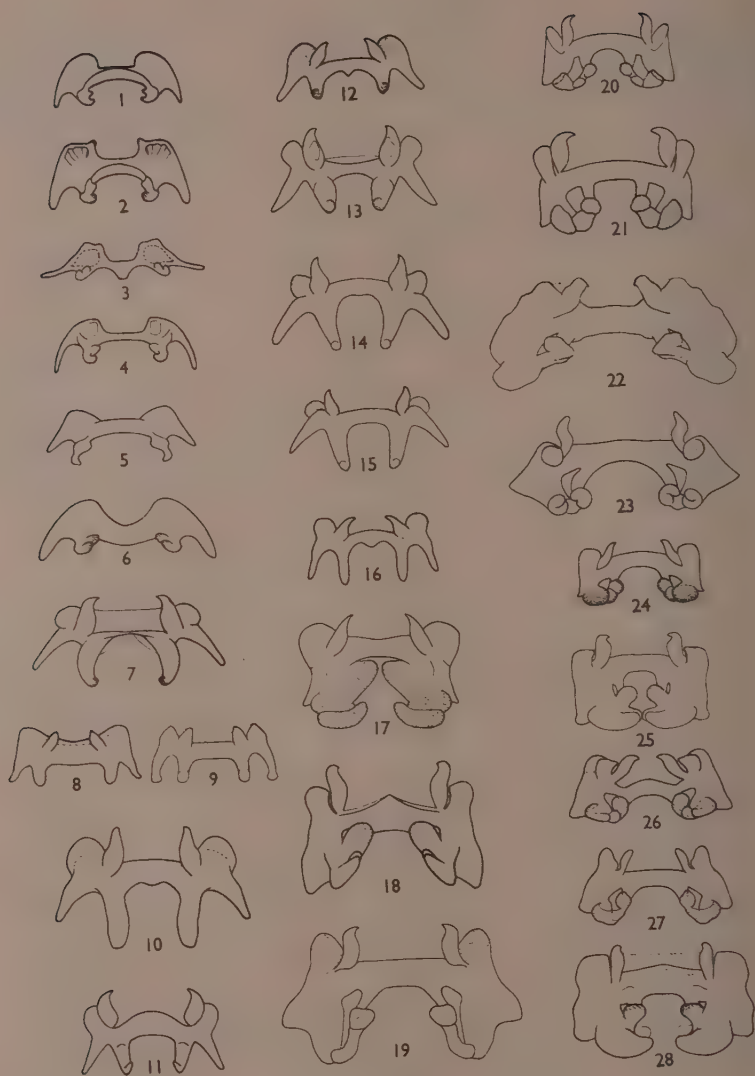
Epiphalli of Hemiacridinae



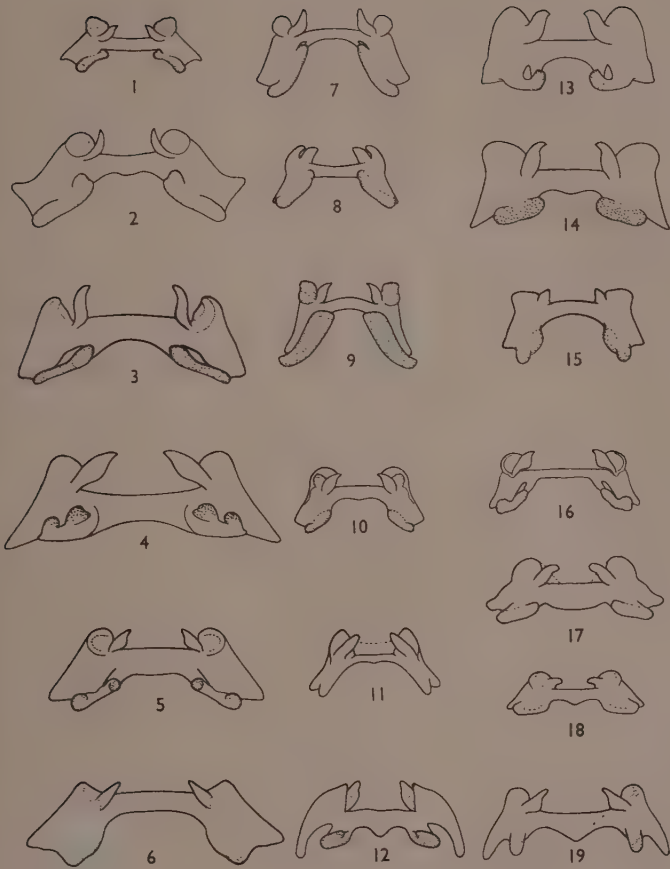
Epiphalli of Hemiacridinae



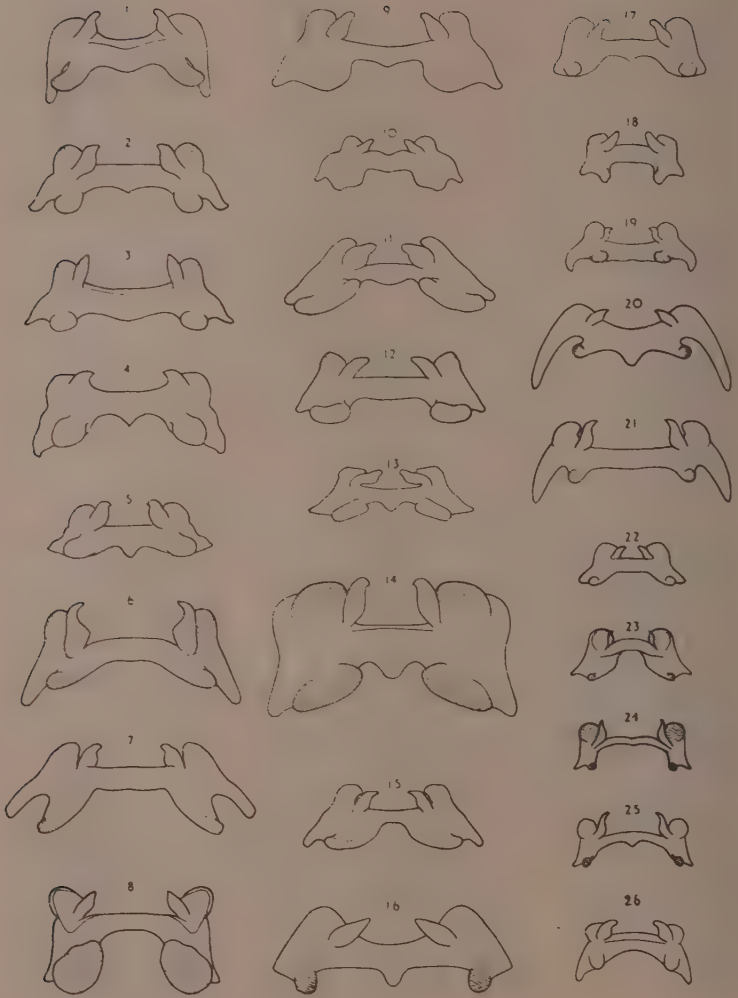
Phallic complex of *Truxalis nasutus* (L.)



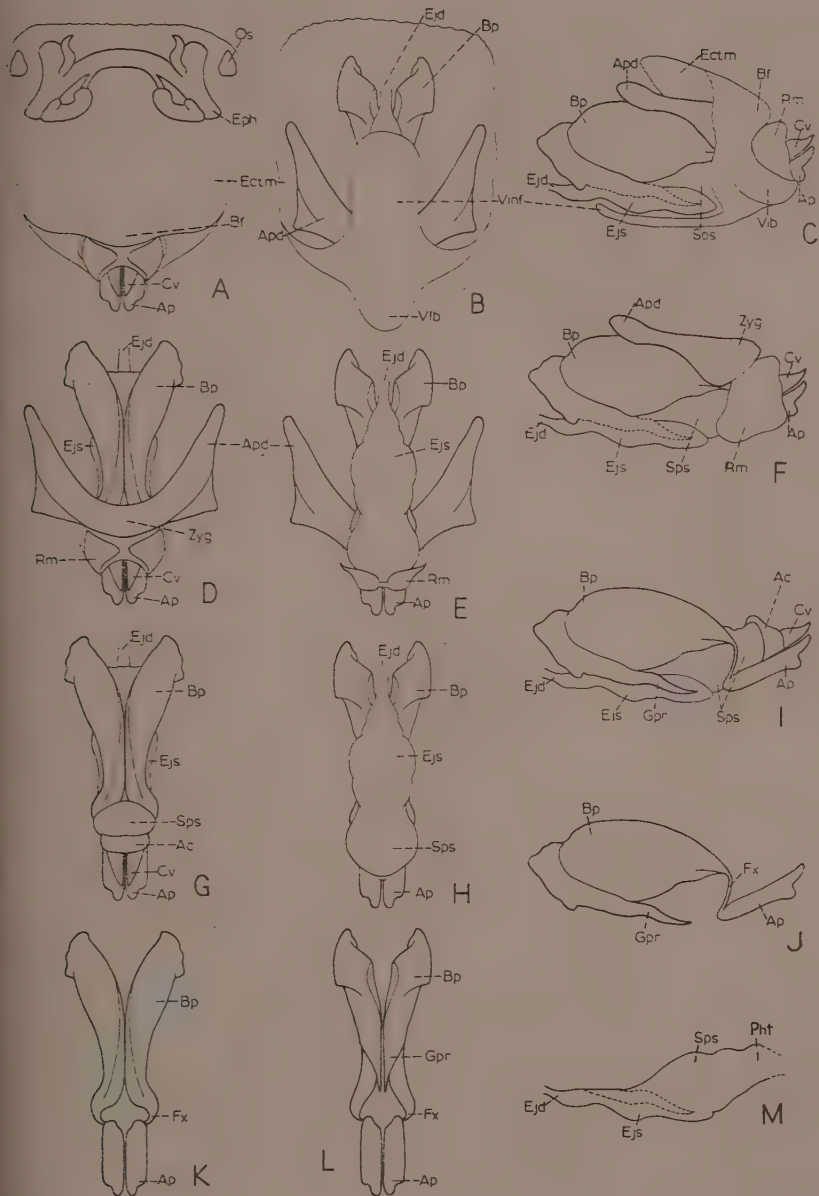
Epiphalli of Pargi (1-6); Acridae (7-28)



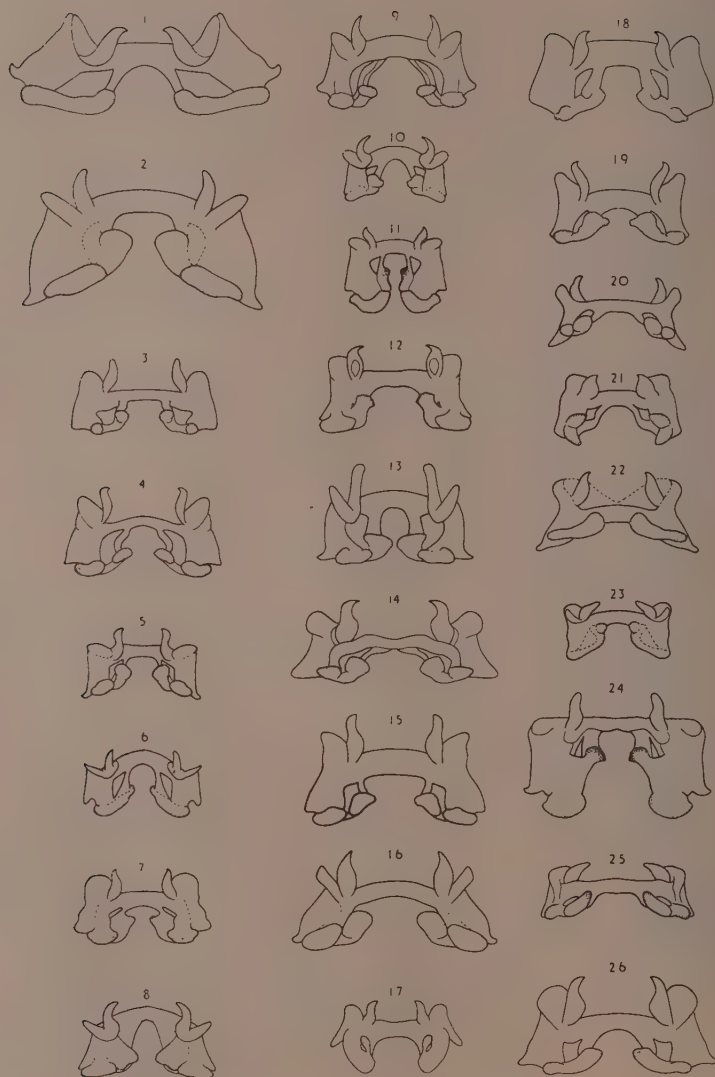
Epiphalli of Acridae



Epiphalli of Acridae



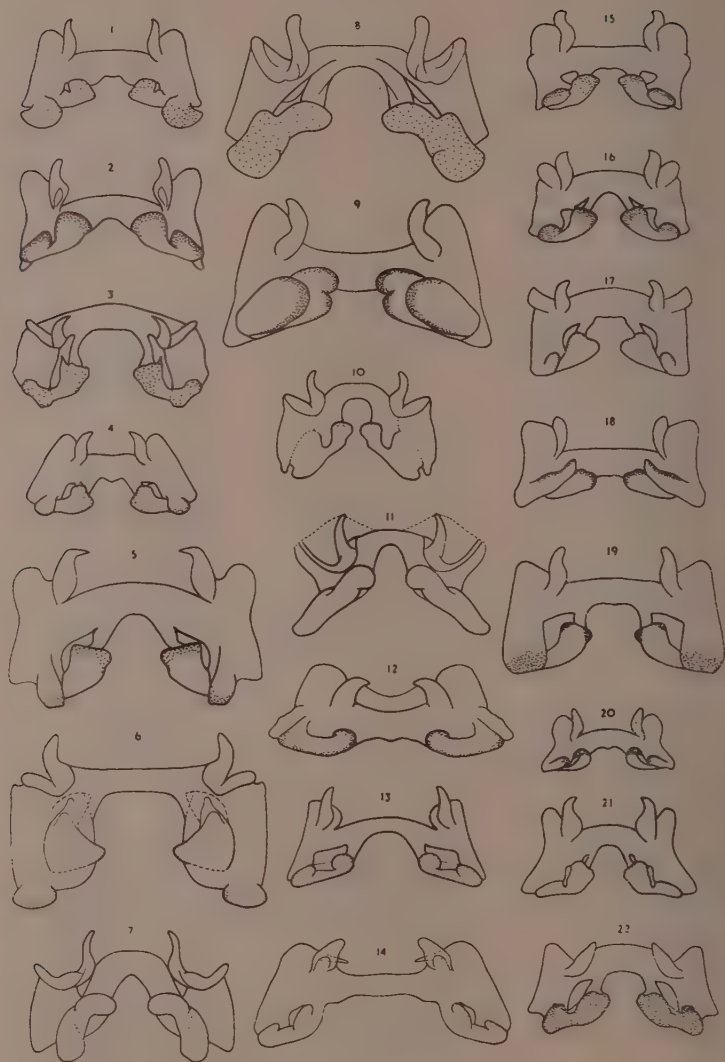
Phallic complex of *Oedipoda caerulea* (L.)



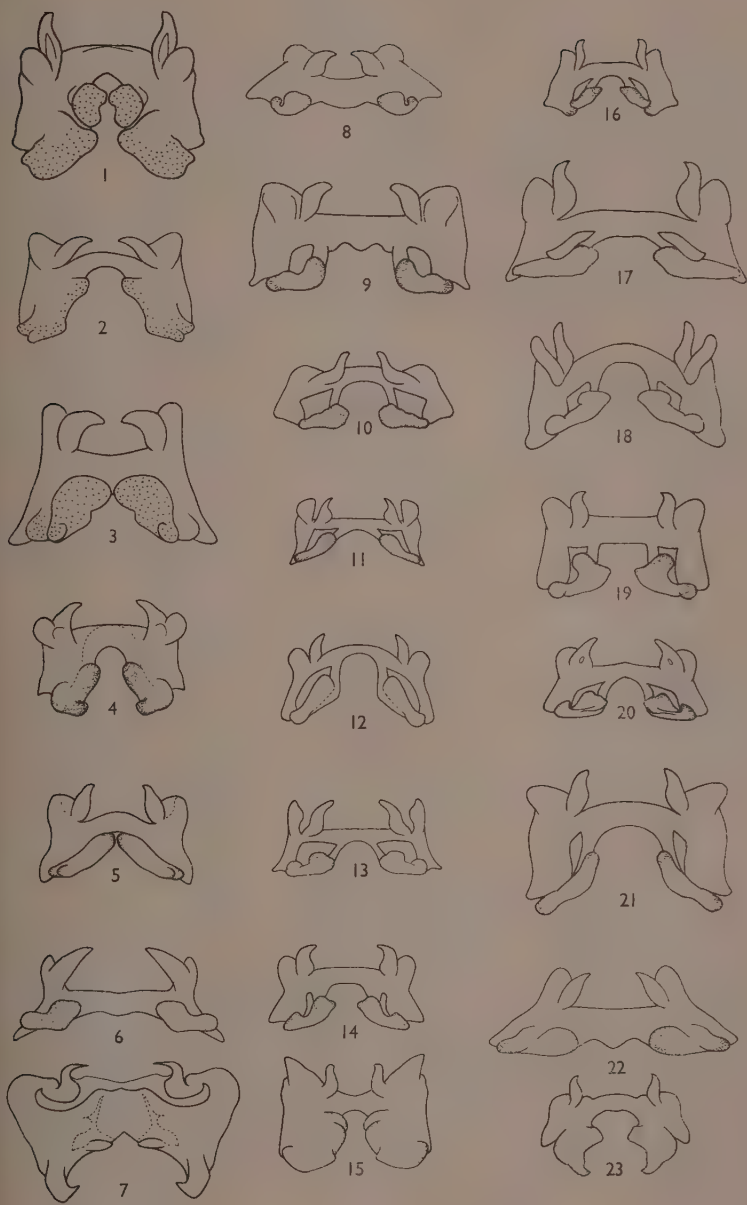
Epiphalli of Oedipodae



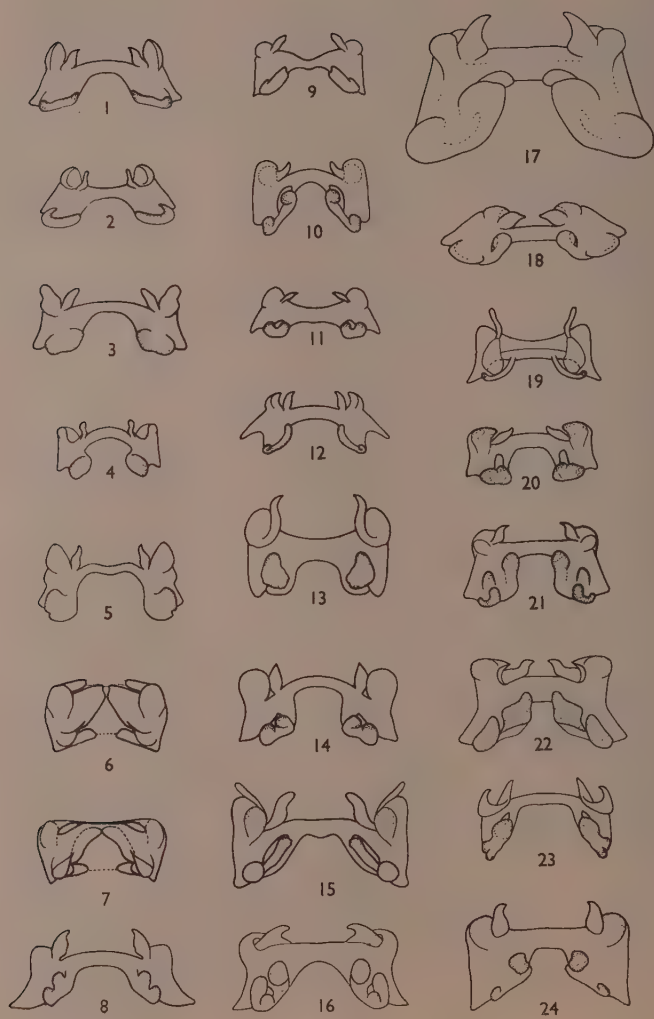
Epiphalli of Oedipodae



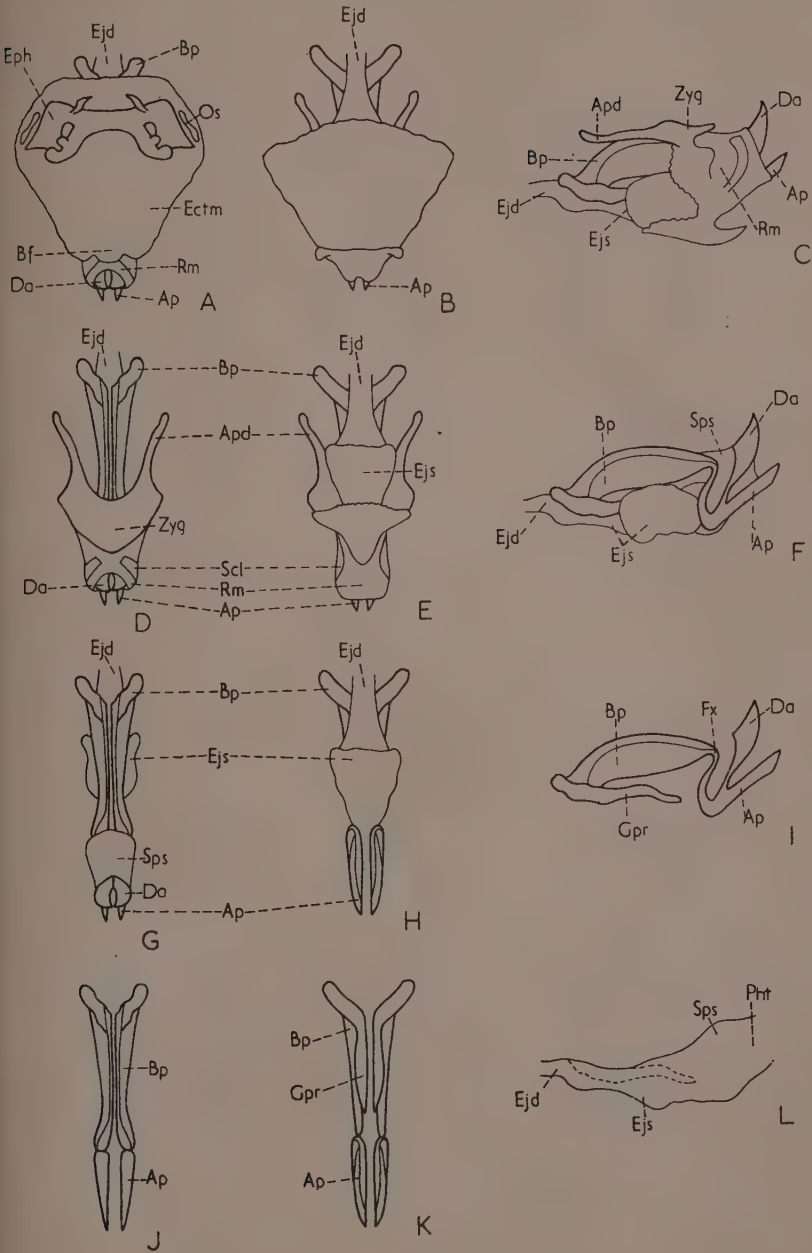
Epiphalli of Oedipodae



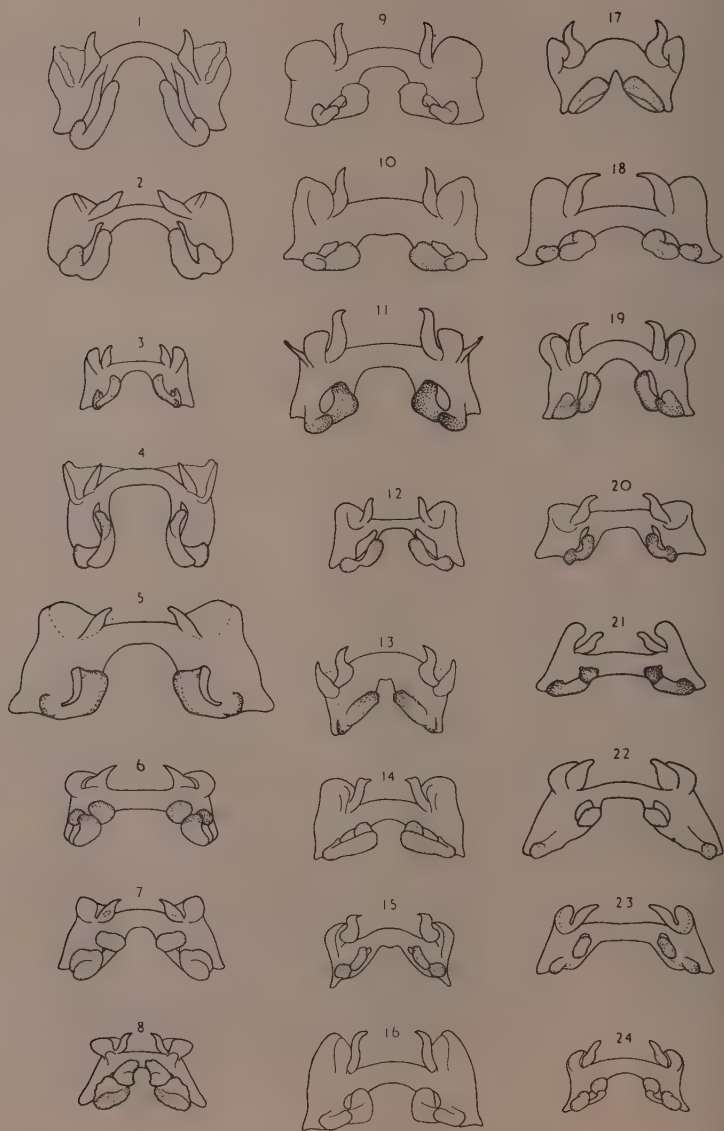
Epiphalli of Oedipodae



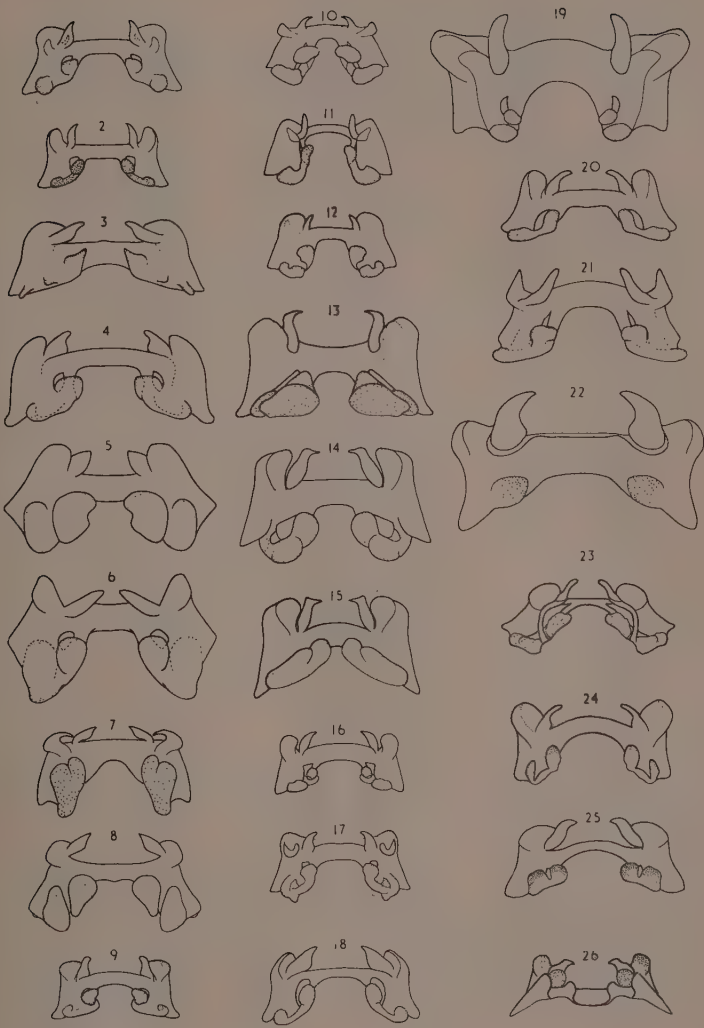
Epiphalli of Egnatiinae (1-5); Eremogryllinae (6, 7); Truxalinae (8-24)



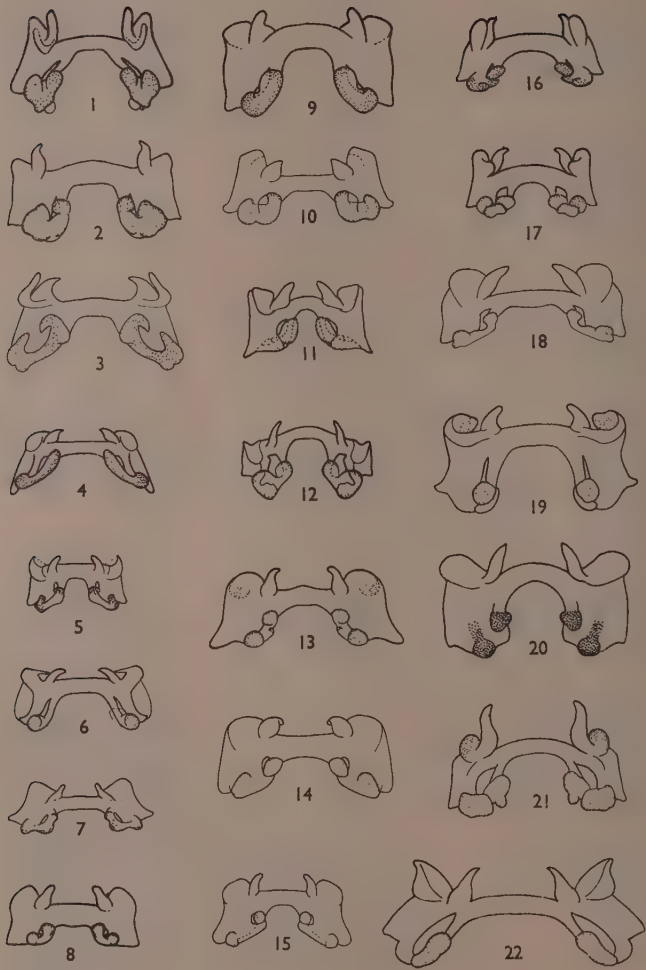
Phallic complex of *Acrida turrita* (L.)



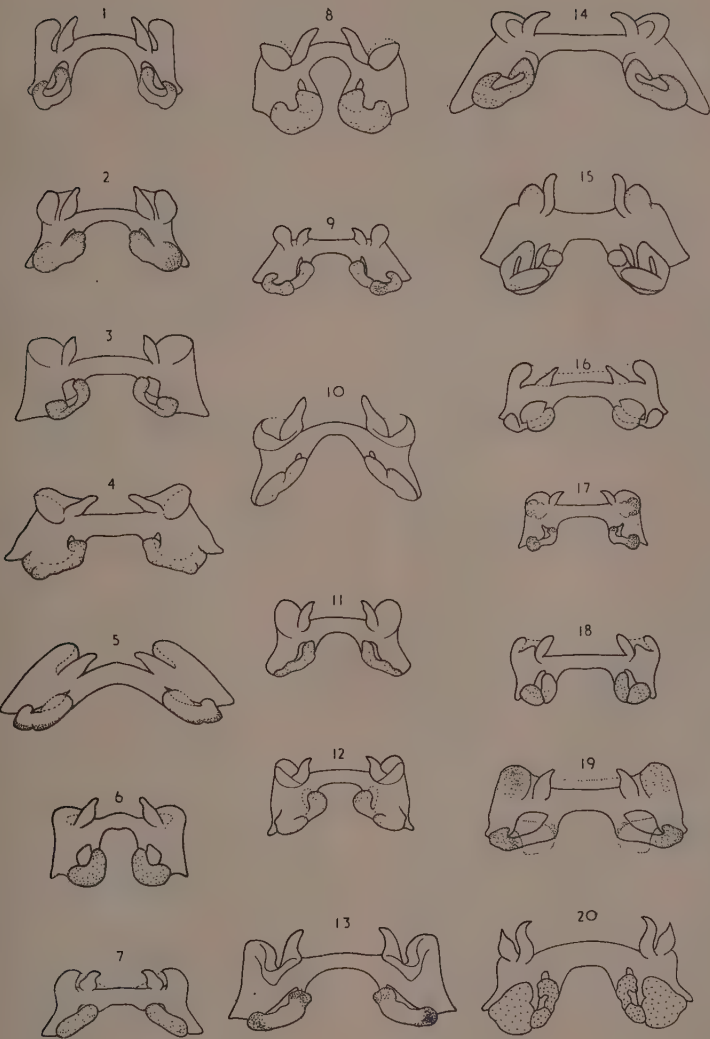
Epiphalli of Truxalinae



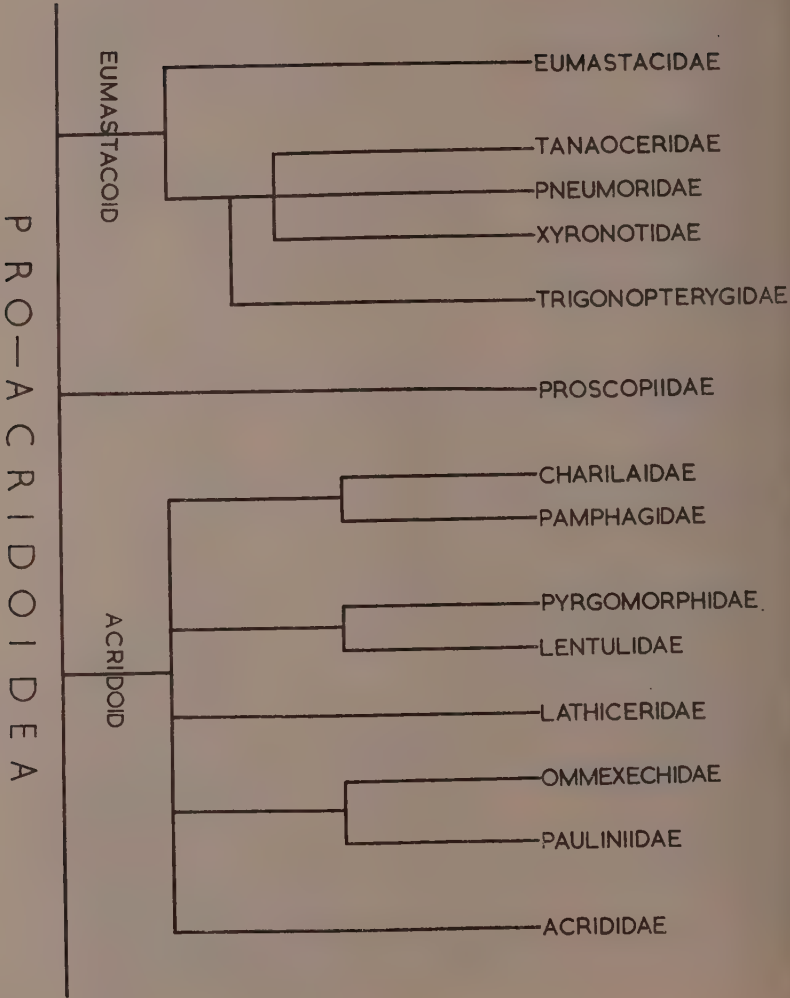
Epiphalli of Truxalinae



Epiphalli of Truxalinae



Epiphalli of Truxalinae



Phylogenetical scheme of Acridoidea

ALPHABETICAL INDEX OF FAMILIES, SUBFAMILIES, GROUPS AND GENERA.

	Page.	Plate.	Fig.		Page.	Plate.	Fig.
Abisares . . .	278	44	12	Anacolopus . . .	281	59	16
Abracris . . .	278	43	10	Anamesacris . . .	278	44	27
Acaeropa . . .	277	41	4	Anapropacris . . .	275	34	24
Acanthacris . . .	275	33	5	Anconia . . .	280	56	22
Acantherus . . .	282	65	8	Aneuryphymus . . .	278	46	4
Acanthoxia . . .	279	49	13	Angaracris . . .	281	57	25
Achurum . . .	282	64	1	Annandalea . . .	273	20	7
Acinipe . . .	273	18	12	Anniceris . . .	278	44	14
Acorypha . . .	278	45	12	Anoxyrrhepes . . .	276	37	19
Acrida . . .	257	51, 53	4	Anthermus . . .	275	34	8
Acridae . . .	257			Apalacris . . .	277	39	20
Acridarachnea . . .	281	60	14	Aphantotropis . . .	272	17	5
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Acridinae . . .	257			Apoboleus . . .	276	37	2
Acridoderes . . .	275	33	4	Apotropis . . .	278	43	14
Acrolophitus . . .	282	64	22	Aptenopedes . . .	278	44	21
Acrophymus . . .	278	46	1	Aptoceras . . .	277	42	16
Acrostegastes . . .	275	31	26	Arcyptera . . .	282	63	22
Acrotylus . . .	280	56	19	Aresceutica . . .	276	37	4
Acteana . . .	279	52	1	Arminda . . .	276	37	13
Adephagus . . .	272	17	7	Arphia . . .	281	58	22
Adimantus . . .	278	44	13	Asemoplus . . .	276	35	17
Adramita . . .	275	33	16	Asiotmethis . . .	272	17	10
Adreppus . . .	277	42	7	Asmara . . .	277	40	25
Aeolacris . . .	275	31	18	Aswatthamanus . . .	281	60	16
Aeoloplus . . .	276	36	6	Atrachelacris . . .	276	36	7
Aerochoreutes . . .	280	56	26	Atractomorpha . . .	273	21	16
Aeropedellus . . .	282	62	17	Aucacris . . .	278	44	29
Afrohippus . . .	281	60	24	Aulacobothrus . . .	282	63	16
Afroxyrrhepes . . .	276	37	15	Aularches . . .	273	21	1
Ageneotettix . . .	282	65	19	Aulocara . . .	282	65	13
Agesander . . .	277	42	20	Aulocaroides . . .	281	59	12
Agriacris . . .	275	31	19	Auloserpusia . . .	276	37	6
Agroecotettix . . .	276	36	4	Austeniella . . .	276	38	6
Agymnastus . . .	281	58	11	Austracris . . .	275	33	9
Aidemonia . . .	276	36	8	Austroicetes . . .	281	59	14
Aiolopus . . .	281	59	10	Azarea . . .	282	63	2
Akicera . . .	273	18	16	Babbabuddinia . . .	280	54	13
Alcamenes . . .	275	31	1	Bactrophora . . .	278	44	25
Aleuas . . .	279	50	8	Badistica . . .	276	38	8
Allaga . . .	278	43	27	Bambusacris . . .	276	37	24
Allotriusia . . .	278	43	18	Basutacris . . .	274	25	6
Amblyphymus . . .	278	46	9	Batrachacris . . .	275	31	17
Amblytropidia . . .	282	64	3	Batrachidaeris . . .	247	26, 27	4
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Amphiprosopia . . .	277	40	12	Batrachotetrix . . .	273	18	1
Amphitornus . . .	282	65	1	Beplessia . . .	277	42	6
Anabibia . . .	278	46	5	Berengueria . . .	282	62	23
Anablepia . . .	282	63	6	Bermius . . .	279	50	11
Anacatanotops . . .	275	34	10	Betisca . . .	273	21	15
Anacranæ . . .	277	41	19	Betiscoides . . .	274	25	13
Anacridium . . .	275	33	18	Bibracte . . .	277	41	11

	Page.	Plate.	Fig.		Page.	Plate.	Fig.
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Biroella . . .	235	5	—	Chibchacris . . .	276	36	17
Bocagella . . .	277	39	19	Chimaroccephala . . .	281	59	6
Bodenheimerella . . .	282	63	11	Chirista . . .	279	52	12
Bootettix . . .	282	64	6	Chitaura . . .	276	38	7
Bothrocaracris . . .	278	45	6	Chloëaltis . . .	282	64	9
Brachaspis . . .	278	44	6	Chloebora . . .	281	58	19
Brachycatantops . . .	275	34	15	Chloroxyrrhepes . . .	276	37	17
Brachycrotaphus . . .	281	60	13	Chlorus . . .	276	36	5
Brachyphymus . . .	278	46	6	Chokwea . . .	280	53	6
Brachystola . . .	275	31	12	Chondracris . . .	275	33	2
Brachyzenia . . .	278	45	9	Chondronotulus . . .	280	56	8
Bradynotes . . .	276	36	22	Choroedocus . . .	277	40	16
Brunnerella . . .	281	58	15	Chorotypinae . . .	235	—	—
Bryodema . . .	281	57	24	Chorotypus . . .	235	—	—
Bryophyma . . .	275	33	20	Chorthippus . . .	282	62	19
Bufonacridella . . .	277	41	26	Chortocicetes . . .	281	59	1
Bufonacris . . .	278	44	30	Chortophaga . . .	281	59	22
Bufonia . . .	278	44	10	Chromacrida . . .	280	53	16
Bullacris . . .	237	11	6	Chromacris . . .	275	31	2
Burtia . . .	278	43	22	Chromotraxalis . . .	281	60	9
Caderia . . .	277	42	9	Chrotogonus . . .	273	21	5
Calamippa . . .	276	37	22	Chrysochraon . . .	281	62	2
Caledia . . .	281	59	2	Cibolacris . . .	280	56	25
Caledonia . . .	276	38	12	Cibotopteryx . . .	275	31	5
Calephorus . . .	281	59	23	Circotettix . . .	281	57	23
Caletes . . .	277	42	14	Cirphula . . .	278	44	9
Calliptamicus . . .	278	46	7	Clinocephalus . . .	282	64	11
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Calliptamuloides . . .	278	46	14	Coenona . . .	276	37	3
Calliptamulus . . .	278	46	12	Colemania . . .	273	20	1
Calliptamus . . .	278	45	1	Colpolopha . . .	275	31	3
Callitala . . .	235	—	—	Comacris . . .	279	52	13
Caloptenopsis . . .	278	45	10	Compsacris . . .	282	64	8
Calviniacris . . .	279	50	6	Compsorhipis . . .	280	56	1
Camnula . . .	281	59	17	Conalcaea . . .	276	36	3
Campylacantha . . .	276	35	7	Coniana . . .	280	56	23
Cannula . . .	280	53	9	Conistica . . .	281	58	20
Capulica . . .	282	62	8	Conometopus . . .	278	44	17
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Caryanda . . .	276	38	9	Conophymacris . . .	277	41	13
Carydana . . .	278	43	25	Conozoa . . .	280	57	17
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Catantopsis . . .	275	34	11	Coryacris . . .	275	31	16
Caudellacris . . .	276	35	5	Coryphistes . . .	277	42	5
Cedarinia . . .	278	43	5	Coscineuta . . .	278	44	19
Celes . . .	281	58	1	Crinita . . .	280	56	6
Ceracris . . .	280	54	6	Crobylostenus . . .	275	34	22
Cercina . . .	276	38	14	Cryptobothrus . . .	279	52	17
Cervidia . . .	277	42	3	Culmulus . . .	280	53	8
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	Page.	Plate.	Fig.		Page.	Plate.	Fig.
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Cyphocerastis .	277	39	17	Euophistes .	277	42	8
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Dasyhippus .	282	62	15	Eupreoptera .	280	54	2
Dendrotettix .	276	35	3	Eupropacris .	275	34	25
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Diablepia .	282	63	5	Euthystira .	281	62	4
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Duroniopsis .	280	54	5	Gelastorhinus .	280	53	14
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Eleutherotheca .	282	62	22	Gerania .	277	41	17
Encoptolophus .	281	59	8	Gesonula .	276	38	3
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Euchorthippus .	282	62	20	Gymnoscirtetis .	276	36	13
Eucoptacra .	277	39	14	Hadrotettix .	280	56	2

	Page.	Plate.	Fig.		Page.	Plate.	Fig.
Halmenus . . .	276	36	15	Leptomerinthophora	277	42	21
Haplotropis . .	273	18	9	Leptopternis . .	280	56	12
Heliastus . . .	280	56	24	Leptoscirtus . .	281	60	5
Heliaula . . .	282	65	7	Lerinnia . . .	281	59	13
Heliapteryx . .	280	56	16	Leuronotina . .	280	57	7
Helioscirtus . .	280	56	14	Leva	282	63	10
Hemiacridinae .	255			Ligurotettix . .	282	65	17
Hemiacris . . .	256	47, 49	5	Lithoscirtus . .	278	44	28
Hemicharilaus .	274	27	3	Lobopoma . . .	280	54	12
Hemipristocorypha	279	49	2	Locheuma . . .	277	42	17
Heniola	276	39	4	Locusta	281	58	5
Hepalicus . . .	278	44	24	Locustana . . .	281	58	6
Hesperotettix . .	276	36	10	Lophacris . . .	275	31	25
Heteracris . . .	277	40	2	Lopheuthymia .	279	49	8
Heteropternis .	281	58	4	Loryma	279	50	14
Hieroglyphus . .	279	49	10	Lucretilis . . .	276	38	5
Hilethera . . .	281	59	11	Luenia	282	62	21
Hippiscus . . .	281	58	7	Machaeridia . .	279	52	3
Holopercna . . .	280	54	21	Machaerocera . .	279	53	3
Homoeopternis .	281	59	18	Macneilia . . .	282	65	4
Homoxyrhopes .	276	37	16	Macrazelota . .	278	44	3
Hoplolopha . . .	272	17	2	Macrocara . . .	277	40	7
Horesidotes . .	282	64	12	Macrocymochta .	280	54	14
Humbe	281	58	16	Macrolopholia .	277	43	2
Humpatella . . .	273	20	9	Macrolobalia . .	277	42	1
Hyalopteryx . .	279	52	21	Madimbania . .	275	34	6
Hyalorrhapis . .	280	56	11	Madurea	281	60	23
Hylopedetes . .	277	42	23	Malagasacris . .	279	49	6
Hyperocnocerus .	280	54	15	Malcolmburria .	279	52	7
Hypochlora . . .	276	36	9	Maphyteus . . .	273	21	14
Indomerus . . .	278	45	4	Martinezius . . .	278	46	11
Inusia	277	39	10	Mastusia	276	39	8
Iranella	277	41	22	Maura	273	21	9
Ischnacrida . . .	279	49	11	Mecostethus . .	281	59	9
Ischnansis . . .	278	43	17	Mecostibus . . .	274	25	8
Ixalidium	278	43	7	Mekongiana . . .	273	20	3
Jasomenia . . .	281	59	5	Melanoplus . . .	276	35	1
Jinabia	277	41	25	Melanotettix . .	279	52	22
Jucundacris . . .	277	40	8	Melicodes	275	33	7
Julea	279	52	8	Meridacris . . .	276	36	1
Kabulia	275	31	20	Mermiria	282	65	14
Kassongia	279	50	5	Meruana	279	49	12
Keya	280	53	18	Mesambria	277	41	1
Kingdonella . . .	276	35	20	Mesasippus . . .	282	62	13
Kraussaria . . .	275	33	6	Mesochloa	282	64	5
Kraussella . . .	282	63	25	Mesopsera	279	49	18
Lactista	280	57	5	Mesopsilla . . .	276	37	23
Lathiceridae . .	246			Mesopsis	282	63	8
Lathicerus . . .	274	27	5	Metaleptea . . .	279	52	23
Laufferia	273	20	19	Metapa	279	49	17
Leiotettix	278	43	9	Metator	280	57	14
Lentula	245	22, 25	1	Metromerus . . .	278	45	2
Lentulidae . . .	244			Microcatantops .	275	34	20
Leprus	281	58	10	Micropodisma . .	276	35	9
Leptacris	279	50	18	Microtes	280	57	4
Leptea	273	21	7	Microtylopteryx .	278	44	23
Leptisma	276	39	3	Mioscirtus	280	57	12
Leptismae	253			Miramella	276	35	11

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Morabinae . . .	235		
Morphacris . . .	280	57	9
Morseiella . . .	282	64	20
Munatia . . .	275	31	22
Myrmeleotettix . . .	282	62	14
Nahuelia . . .	278	44	20
Napaia . . .	282	65	6
Naraikadua . . .	277	41	16
Navasia . . .	277	40	6
Neritius . . .	277	40	22
Netrosoma . . .	276	36	12
Niitacris . . .	276	36	2
Nisiocatantops . . .	277	41	8
Nocaracris . . .	273	18	6
Nocarodes . . .	273	18	5
Nomadacris . . .	275	33	10
Notopleura . . .	281	60	6
Notostaurus . . .	282	63	21
Nyassacris . . .	274	25	7
Ochlandriphaga . . .	276	38	4
Ochirilidia . . .	282	62	6
Ochrophlebia . . .	273	20	5
Ocneridia . . .	273	18	7
Ocneropsis . . .	273	18	10
Ocnocerus . . .	280	54	23
Odontomelus . . .	279	53	2
Odontopodisma . . .	276	35	8
Oedaleus . . .	281	58	2
Oedipoda . . .	258	55, 57	10
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Ommatolampis . . .	277	42	22
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Omocestus . . .	282	63	13
Omura . . .	273	21	17
Opaeonella . . .	277	42	24
Opharicus . . .	277	39	23
Opitacris . . .	277	41	23
Opsomala . . .	276	39	1
Oraistes . . .	279	49	9
Orbillus . . .	275	34	23
Orchamus . . .	273	18	11
Ornithacris . . .	275	33	17
Oropodisma . . .	276	35	13
Orphulella . . .	282	64	16
Orthacanthacris . . .	275	33	23
Orthacris . . .	273	20	15
Orthochtha . . .	280	54	4
Osmilia . . .	278	43	12
Oxya . . .	276	38	1
Oxyae . . .	253		
Oxyaidea . . .	277	40	24
Oxyblepta . . .	276	39	5
Oxybleptella . . .	276	39	6
Oxybothrus . . .	279	52	16

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Oxycatantops . . .	275	34	14
Oxyparga . . .	280	53	11
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Pachycatantops . . .	275	34	19
Pachynotacris . . .	275	33	11
Pachypodisma . . .	276	35	15
Pacurria . . .	277	42	4
Palniacris . . .	277	41	2
Pamaeris . . .	280	54	11
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Pamphagus . . .	242	16, 18	8
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Paracardenius . . .	275	34	4
Parachleobata . . .	279	52	24
Paracinema . . .	281	59	3
Paracomaeris . . .	279	52	11
Paraconophyma . . .	277	41	6
Paracoptacra . . .	277	39	13
Paracornops . . .	277	39	11
Paraduronia . . .	280	54	25
Paraeuprepocnemis . . .	277	40	19
Paragonista . . .	282	62	7
Paragymono- bothrus . . .	282	63	17
Parahieroglyphus . . .	279	50	17
Paraidemona . . .	276	36	24
Paralentula . . .	274	25	2
Paralobopoma . . .	280	53	17
Paranocarodes . . .	273	18	4
Paraparga . . .	279	52	4
Parapetasia . . .	273	21	10
Paraphlaeoba . . .	280	54	24
Parapleurus . . .	281	59	21
Parapropacris . . .	275	34	26
Parascopas . . .	276	35	22
Paraspathosternum . . .	279	50	15
Parasphena . . .	273	20	16
Parathisoicetrus . . .	277	40	13
Paratraulia . . .	279	50	2
Paratruxalis . . .	279	52	25
Parazelum . . .	277	43	1
Pardalophora . . .	281	58	8
Pardillana . . .	277	42	11
Parepistaurus . . .	277	39	16
Pareuthymia . . .	279	49	7
Parga . . .	279	52	5
Pargae . . .	258		
Paropomala . . .	282	64	10
Parorphula . . .	279	52	26
Parossa . . .	274	27	10
Paroxya . . .	276	35	18
Pasiphimus . . .	280	53	10
Patanga . . .	275	33	15
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Peakesia . . .	277	43	3

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Pedies . . .	276	36	21	Prionosthenus . .	273	18	14
Pedioscirtetes . .	282	64	19	Prionotropis . .	272	17	6
Pelecinotus . . .	275	31	9	Pristocorypha . .	279	49	1
Perakia	279	50	9	Procolpia	275	31	11
Perbellia	278	43	13	Proctolabus . . .	278	44	18
Perella	280	54	3	Proscopia	240	14	
Peripolus	278	45	3	Proscopiidae . . .	240		
Peruvia	282	65	15	Prosphena	273	20	10
Pezocatantops . .	275	34	16	Prumnacris	276	35	16
Pezotettix	278	43	24	Psectrocnemus . .	281	60	19
Phaedrotettix . .	276	36	18	Pseudocryptera . .	281	60	22
Phaeocatantops . .	275	34	12	Pseudocarsula . .	279	50	13
Phaeonotus	280	56	13	Pseudoceles	280	56	3
Phaeoparia	278	44	2	Pseudogmothela . .	282	62	24
Phalaca	277	41	12	Pseudophialosphaera	276	37	5
Phalinus	279	49	3	Pseudophlaeoba . .	280	54	19
Phaneroцерус . .	278	44	1	Pseudopomala . . .	282	65	5
Phaulacridium . .	278	44	15	Pseudoprumna . .	276	35	10
Phaulotettix . . .	276	36	19	Pseudotrimerop-			
Philippiacris . . .	278	44	26	tropis	281	57	21
Philocleon	276	35	19	Psiloscirtus	277	42	18
Phlaeoba	280	53	5	Psinidia	280	57	13
Phlaeobida	280	54	26	Psoloessa	282	65	9
Phlibostroma . . .	282	65	10	Psophus	281	58	12
Phlocerus	282	62	10	Pternoscirta	280	56	18
Phoetaliotes . . .	276	36	23	Pternoscirtus . . .	281	59	20
Phonogaster	281	60	12	Pteropera	278	43	20
Phrynotettix . . .	275	31	13	Pteroperina	278	43	19
Phyllocercus . . .	277	40	1	Pterotiltus	276	38	15
Phymateus	243	19, 21	11	Ptetica	280	57	11
Phymeurus	278	46	2	Ptygonotus	281	60	15
Physemacris	238	10, 11	5	Pusana	280	56	17
Phyxacra	275	33	12	Pycnocrania	281	58	18
Pileolum	277	41	24	Pynodictya	281	58	17
Pirithoicus	275	34	21	Pynostictus	280	56	21
Platacanthoides . .	278	46	10	Pyrganthermus . . .	275	34	7
Platybothrus . . .	282	64	21	Pyrgodera	281	58	13
Platylactista . . .	280	57	8	Pyrgomorpha	273	21	6
Platypternella . .	282	63	7	Pyrgomorphella . .	273	21	4
Platypternodes . .	282	63	1	Pyrgomorphidae . .	243		
Plegmapteropsis . .	278	46	8	Pyrgophlaeoba . . .	280	54	7
Plotnikovia	276	37	8	Qualetta	280	56	20
Pneumora	272	11	7	Quangula	281	60	10
Pneumoridae . . .	237			Quilta	276	38	2
Pnorisa	282	63	18	Racilia	276	38	11
Pododula	278	44	11	Ramburiella	282	63	24
Podisma	276	35	2	Ramphacrida	279	50	1
Podismae	251			Rapsilla	281	59	7
Podismopsis	281	62	1	Rasperecta	280	54	8
Poecilocerastis . .	277	39	18	Rehnula	274	25	4
Poecilochroma . . .	277	41	7	Rhabdoplea	280	53	15
Poecilocerus	273	21	13	Rachicreagra	277	42	26
Popovia	273	20	20	Rhachitopsis	278	46	13
Praxibulus	278	44	5	Rhadinacris	275	33	8
Primnia	281	60	20	Rhadinotatum . . .	279	52	27
Primnoa	276	35	14	Rhaphotittha	282	63	9
Prionocantha . . .	236			Rhienoderma	274	25	15
Prionolopha	275	31	14	Rhytidacris	275	33	1

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Rhytidochrota . . .	277	42	19	Taeniopoda . . .	275	31	15
Roduniella . . .	279	52	9	Tagasta . . .	273	20	13
Romalea . . .	250	30, 31	7	Tanaoceridae . . .	237		
Romaleinae . . .	242			Tanaocerus . . .	272	11	1
Ruwendoracris . . .	277	39	21	Tanita . . .	273	20	11
Saussurea . . .	272	17	1	Tapesia . . .	273	21	12
Schistocerca . . .	275	33	22	Taphronota . . .	273	21	2
Schizobothrus . . .	280	53	13	Taramassus . . .	277	40	11
Scintharista . . .	281	58	21	Tarbaleus . . .	256	48, 49	15
Scirtetica . . .	280	57	2	Tenuitarsus . . .	273	20	17
Scotussa . . .	276	36	16	Teratodes . . .	275	31	28
Scutilla . . .	273	20	6	Terpillaria . . .	278	43	15
Scyllina . . .	282	64	14	Tetrataenia . . .	277	39	9
Sedulia . . .	277	41	9	Thalpomena . . .	280	56	4
Segellia . . .	278	43	8	Thisoicetrellus . . .	277	40	4
Serpusia . . .	276	37	7	Thisoicetrinus . . .	277	40	21
Serpusiae . . .	252			Thisoicetrus . . .	277	40	18
Shelfordites . . .	274	25	10	Thyridota . . .	282	63	3
Sherifuria . . .	280	54	9	Thyriptilon . . .	279	52	28
Shortridgea . . .	272	11	8	Tinnevellia . . .	276	37	20
Sikkimiana . . .	280	54	16	Titanaecris . . .	275	31	24
Silvitettix . . .	282	64	13	Tmethis . . .	273	17	11
Sinaloa . . .	276	36	14	Tmetonota . . .	280	57	20
Sinipta . . .	282	65	3	Tolgadia . . .	278	44	4
Siruvania . . .	277	41	10	Tomonotus . . .	280	57	6
Sitacles . . .	277	42	25	Tonkinaecris . . .	276	35	6
Somalella . . .	280	56	5	Trachypetrella . . .	272	17	4
Spharagemon . . .	280	57	3	Trachyrhachys . . .	280	57	15
Spathalium . . .	274	27	8	Traulia . . .	277	39	24
Spathosternum . . .	279	50	4	Traulidea . . .	277	41	14
Sphenarium . . .	273	20	8	Trepidulus . . .	280	57	16
Sphenophyma . . .	276	37	14	Trichocatantops . . .	275	34	5
Sphingonotus . . .	280	56	15	Trigonophymus . . .	278	43	11
Sphodromerus . . .	278	45	8	Trigonopterygidae . . .	238		
Sphodronotus . . .	278	45	7	Trigonopteryx . . .	239	11, 12	3
Sporobolus . . .	282	63	4	Trilophidia . . .	280	57	19
Staurocleis . . .	275	34	1	Trimerotropis . . .	281	57	22
Stauroderus . . .	282	62	18	Tristria . . .	276	37	18
Staurorhectus . . .	282	64	18	Tropidacris . . .	275	31	27
Stenacris . . .	276	39	2	Tropidauchen . . .	273	18	15
Stenobothrus . . .	282	63	14, 15	Tropidiopsis . . .	277	40	3
Stenocatantops . . .	275	34	27	Tropidolophus . . .	281	58	14
Stenocroblyus . . .	275	34	28	Tropidopola . . .	276	37	21
Stenohippus . . .	282	63	12	Tropidopolae . . .	252		
Stenoxiphus . . .	273	20	12	Tropidostethus . . .	275	31	8
Stibarosterna . . .	273	20	4	Truxalinae . . .	259		
Stirapleura . . .	282	65	12	Truxalis . . .	259	60, 61	8
Stobbea . . .	278	45	5	Truxaloides . . .	281	60	11
Stropis . . .	278	43	4	Tuarega . . .	272	17	9
Strumiger . . .	273	17	15	Tylotropidius . . .	277	40	17
Sudanacris . . .	279	50	10	Tythyotyle . . .	275	31	21
Sumba . . .	280	54	22	Uganda . . .	281	59	4
Swaziacris . . .	274	25	14	Urnisia . . .	278	44	7
Sygrus . . .	274	25	3	Urugalla . . .	277	41	3
Syntomacris . . .	277	42	13	Usambilla . . .	274	25	5
Syrbula . . .	282	65	20	Utanaecris . . .	277	41	20
Systella . . .	239	11, 13	4	Utubius . . .	273	17	14
Taeniophora . . .	278	44	22	Valanga . . .	275	33	3

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Vosseleriana . .	280	56	10
Weenenia . .	280	54	10
Wellawaya . .	280	54	17
Wernerella . .	280	56	9
Willemsea . .	275	33	21
Willemsella . .	279	50	12
Wilverthia . .	279	52	6
Xanthippus . .	281	58	9
Xenippa . .	279	50	3
Xenocatantops . .	275	34	18
Xerhippus . .	282	62	12
Xerophlaeoba . .	280	54	20

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Xiphiola . .	277	42	12
Xyleus . .	275	31	10
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Xyronotus . .	272	11	2
Zacompsa . .	279	52	10
Zarytes . .	273	21	3
Zapata . .	282	65	11
Zoniopoda . .	275	31	6
Zonocerus . .	273	21	8
Zubovskya . .	276	35	12
Zygoclistron . .	279	50	7
Zygophlaeoba . .	280	54	18